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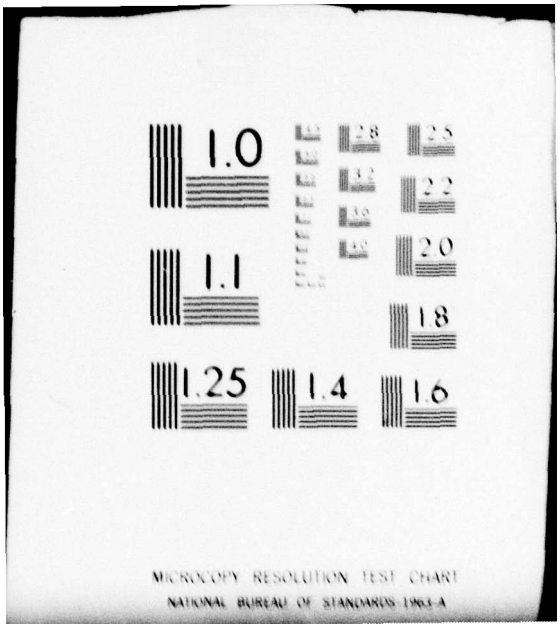
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Tactical Engagement Simulation Training Techniques: Indirect Fire Simulation Procedures

Engagement Simulation Technical Area

January 1979

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An integral part of tactical engagement simulation training is the simulation of indirect fire weapons and their effects. Mortar and artillery fire represent important sources of firepower to the tactical commander; the opportunity must be given for him to learn the proper employment of this combat asset.

The indirect fire simulation procedures which are described in Training Circular (TC) 71-5, REALTRAIN, cover only indirect fire simulation for engagement simulation exercises at the platoon level and below and involve

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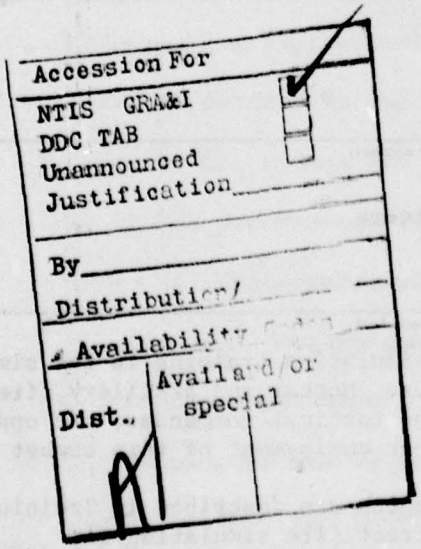
only the play of the Forward Observer and the simulation of incoming rounds. Not included in TC 71-5 are refined indirect fire simulation procedures for platoon and below, simulation procedures for larger size units, procedures for including the artillery Fire Direction Center as part of the exercise, or procedures for including the firing element itself into exercise play.

Research was undertaken by ARI in 1976 to improve indirect fire simulation procedures for tactical engagement simulation exercises. In spite of the importance of indirect fire simulation to effective tactical training, to date this aspect of tactical engagement simulation training has defied major improvement through technological advances in hardware. Application of laser or other technologies to indirect fire simulation has not proven feasible. Therefore, improved manual procedures have been required to effect improvements in this important area of engagement simulation.

The indirect fire simulation Training Circular which comprises the major part of this document is the result of research on improved and expanded procedures for integrating all aspects of indirect fire simulation into tactical engagement simulation training. Most of the indirect fire simulation procedures described in the Training Circular have been tried out in the field (usually as part of a larger test effort); those procedures not subjected to test in the field are logical extensions of procedures for smaller size tactical units.

This Training Circular has been written for the user in the field. It describes the duties of the personnel required for effective indirect fire simulation, delineates the staffing and organization of facilities required for control of indirect fire simulation in the context of engagement simulation exercises, and presents a detailed description of procedures to be followed.



Research Product

TACTICAL ENGAGEMENT SIMULATION TRAINING TECHNIQUES: INDIRECT FIRE SIMULATION PROCEDURES

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Tactical Skill Acquisition and Retention

FOREWORD

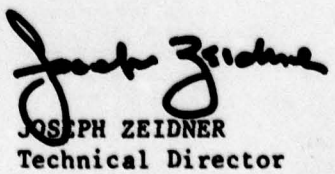
Learning tactical skills on the battlefield is costly; learning tactical skills short of a real combat environment is difficult. Yet this is precisely the Army's training mission -- the training of troops in tactical skills and the constant improvement of the effectiveness and efficiency of that training.

In 1971 the Army Research Institute for the Behavioral and Social Sciences (ARI) with TRADOC initiated research which led to development of a tactical training method now known as tactical engagement simulation training. Two tactical engagement simulation training techniques have been implemented Army-wide: SCOPES (Squad Combat Operations Exercises (Simulation)) for infantry squad training and REALTRAIN for armor, anti-armor and combined arms training.

Engagement simulation training was designed to require the same tactical behaviors as combat. Embodied in the REALTRAIN model are a number of learning principles which have again been demonstrated to be important for effective training. Probably most important is that the competitive nature of REALTRAIN exercises provides the motivation to learn, an element often lacking in Army training.

The potential of engagement simulation training has been demonstrated. For this potential to be realized fully, further research has been required to refine current engagement simulation training techniques to make them more effective and to extend these techniques to other areas of application. Because of the demonstrated importance of indirect fire (mortar or artillery) simulation in an engagement simulation training environment, a research effort was initiated: to refine the initial indirect fire simulation procedures for platoon and below; to extend indirect fire procedures to larger tactical units; and to include the artillery fire direction center (FDC) and firing elements (mortar sections, artillery batteries) in the play of tactical engagement simulation training exercises. The results of this research are presented here in the form of a draft Training Circular.

This research was part of a larger research program which is responsive to the requirements of RDT&E Project 2Q763743A773 and the TRADOC System Manager for Tactical Engagement Simulation of the US Army Training Support Center, Fort Eustis, Virginia.



JOSEPH ZEIDNER
Technical Director

PREFACE

An integral part of tactical engagement simulation training is the simulation of indirect fire weapons and their effects. Mortar and artillery fire represent important sources of firepower to the tactical commander; the opportunity must be given for him to learn the proper employment of this combat asset.

There are five steps in the sequence of events involved in indirect fire:

(1) the forward observer (FO) or fire support team (FIST) assists maneuver elements in calling in indirect fire on the enemy,

(2) the fire direction center (FDC) processes requests from the FO or FIST and issues firing directions to the firing elements,

(3) the firing elements initiate the fire mission,

(4) mortar or artillery rounds impact on or near the enemy, and

(5) the FO/FIST adjust subsequent rounds based on observation of impacting rounds.

Indirect fire simulation for squad-level SCOPES exercises and platoon-level REALTRAIN exercises concentrated on the first, fourth and fifth steps. Indirect fire simulation techniques permit the FO (or other tactical player) to call in simulated rounds and to adjust succeeding rounds on to the target. This necessitated the simulation of indirect fire effects - the fourth step in the chain of events. Special emphasis was required on simulating incoming indirect fire rounds, not only because the FO requires feedback on the accuracy of his mission request, but also to provide troops on the ground with realistic, but safe, indication that they are under attack by indirect fire. This simulation also provides a means for the objective assessment of casualties from indirect fire.

Simulation of the effects of indirect fire required the development of procedures for delivering simulated indirect fire rounds where they are called for and the use of an artillery simulator to represent the "flash-bang" of an incoming round. This combination of procedures provides sufficient indication of the troops on the ground that they are being engaged by indirect fire and provides adequate feedback to the person requesting a given fire mission that is has been executed.

As with all REALTRAIN procedures, the purpose of these indirect fire procedures is to provide soldiers the opportunity to practice the execution of tactical behaviors. They permit the realistic integration of the forward observer (FO) into his assigned maneuver element. Fire support planning is conducted as it would be in actual combat to include establishing preplanned fires, registration points and final protective fires. Fire direction radio nets can be used by either maneuver element leaders or forward observers to request fire from a simulated Fire Direction Center (FDC). The simulated FDC translates the request for fire into instructions for vehicle-mounted controllers (firemarkers) who place artillery simulators at the location desired in real time. Unit leaders and FO's are then able to observe the rounds and request subsequent adjustments. Thus, the leader and forward observer are required to practice the entire range of skills necessary to employ indirect fire effectively.

By placing unit leaders and FO's into an actual two-sided, free-play tactical training environment, the more subtle techniques of employing indirect fire weapons can be learned. Through tactical engagement simulation exercises they can learn: what constitutes an effective fire plan at the platoon level; where and when concentrations should be

registered prior to an actual operation; where the FO should position himself to be most effective; how much of fire planning and its execution is the FO's responsibility, how much the unit leader's; at what types of targets the leader should employ his indirect fire as opposed to his direct fire weapons.

At the same time that tactical leaders are learning how to maximize the effectiveness of indirect fire on the enemy, their men are learning how to minimize the effects of the enemy's indirect fire through the use of proper cover, dispersion, etc. Because indirect fire casualties are assessed according to strict rules of engagement, the psychological fidelity of indirect fire simulation motivates troops on the ground to perform as they would in combat to reduce the chance of becoming a casualty to indirect fire.

The indirect fire simulation procedures which are described in Training Circular (TC) 71-5, REALTRAIN, cover only indirect fire simulation for engagement simulation exercises at the platoon level and below and involve only the play of the Forward Observer and the simulation of incoming rounds. Not included in TC 71-5 are refined indirect fire simulation procedures for platoon and below, simulation procedures for larger size units, procedures for including the artillery Fire Direction Center as part of the exercise, or procedures for including the firing element itself into exercise play.

Research was undertaken by ARI in 1976 to improve indirect fire simulation procedures for tactical engagement simulation exercises. In spite of the importance of indirect fire simulation to effective tactical training, to date this aspect of tactical engagement simulation training

has defied major improvement through technological advances in hardware. Direct fire simulation has been improved through automatic casualty assessment permitted by Multiple Integrated Laser Engagement System (MILES), which employs eye-safe laser technology. Application of laser or other technologies to indirect fire simulation has not proven feasible. Therefore, improved manual procedures have been required to effect improvements in this important area of engagement simulation.

The indirect fire simulation Training Circular which comprises the major part of this document is the result of research on improved and expanded procedures for integrating all aspects of indirect fire simulation into tactical engagement simulation training. Most of the indirect fire simulation procedures described in the Training Circular have been tried out in the field (usually as part of a larger test effort); those procedures not subjected to test in the field are logical extensions of procedures for smaller size tactical units.

This Training Circular has been written for the user in the field. It describes the duties of the personnel required for effective indirect fire simulation, delineates the staffing and organization of facilities required for control of indirect fire simulation in the context of engagement simulation exercises, and presents a detailed description of procedures to be followed for the following simulation modules.

MODULE	MANEUVER FORCE SIZE	FIST MEMBER PER SIDE	INDIRECT FIRE ELEMENTS PLAYED
A	Platoon or less	1	·FC
B	Platoon team	1	·FO ·Fire Direction Center (optional)
C	Platoon and above	Multiple	·FO/FIST
D	Platoon and above	Multiple	·FO/FIST ·Fire Direction Center
E	Company and above	Multiple	·FIST ·Fire Direction Center ·Firing Battery
F	Armored Cavalry Platoon/Infantry	Multiple (May be cavalry scout sections)	·Organic mortar section(s)

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SECTION I. GENERAL

1. Introduction

a. In combat, victory is the product of the efforts of a commander and of his staff using the assets of a combined arms team. This team consists of the maneuver elements, armor and infantry, and fire support elements, organic, e.g., mortars, or supporting, e.g., field artillery. A combined arms engagement simulation exercise would, therefore, be incomplete without representation of the combat power of the tank, infantry and indirect fire weapons. Indirect fire is the greatest killer on the battlefield. Its effects must be depicted accurately, quickly and realistically in all combined arms exercises in order to train the commander, his staff and all the troops under realistic battlefield situations.

b. In simulating indirect fires, the duties and functions of the fire support team (FIST), the fire direction center (FDC) and the firing battery (FB)* are the same as they would be in combat. Engagement simulation enters into the means and procedures for depicting the effects of indirect fire onto the proper piece of terrain in as near realtime as possible. Fire markers, a fire marker control center (FMCC) and controllers at FB may be used to provide engagement simulation. This chapter provides modules involving different combinations of FIST, FDC, FB, FMCC and fire markers. The commander should select the module that fits his training objective, situation and assets for use in engagement simulation exercises.

c. In indirect fire simulation, the elements of the indirect fire system perform their normal roles, e.g., FIST members advise the maneuver unit commander on fire support, prepare fire plans and call for fire, FDCs compute firing data, FBs place data on the guns. (Not all elements are required for effective simulation—the commander plays those elements he judges would get and/or provide maximum training benefit from engagement simulation.) Simulation enters into the picture in the effects portion of indirect fire. Instead of projectiles fired from tubes exploding on the battlefield, pyrotechnic simulators are detonated by fire markers at the points where the projectiles would have impacted. The simulators serve several purposes; they enhance the realism of the training battlefield, they

*The term "firing battery" is used to include both field artillery and mortar units.

train the maneuver units in how to act under fire, they enable the maneuver unit controllers to declare casualties, and they allow the FIST to adjust fire onto targets.

d. Example: In a REALTRAIN exercise, a tank platoon with a mechanized infantry squad attached is attacking a position defended by two infantry squads with two TOW sections attached. In order to reach its objective, the tank platoon has to cross one thousand meters of open field. The FIST member with the tank platoon recommends to the platoon leader the smoke be placed on the objective just before the tanks enter the open field. He further points out a possible TOW location that would be attacked with indirect fire. The platoon leader agrees. The FIST member then requests fire on the TOW position using normal procedures. FMCC acknowledges the request for fire and directs a fire marker to drop a simulator at the requested coordinates. The FIST member observes the simulator and adjusts it just as he would a live HE round until he is ready to go into fire for effect. When he asks for fire for effect, FMCC directs the fire marker to detonate simulators to mark the center and the four corners of the fire for effect. The fire marker and maneuver controllers assess casualties during both the adjustment and fire for effect phases. When the platoon is ready to cross the open area, the FIST member can determine the wind effects and adjust the location of the smoke to give the best screen. When the FIST member asks for smoke in effect, FMCC directs the fire marker to ignite a smoke pot at the desired spot. With the enemy's vision blocked by the smoke, the platoon successfully negotiates the open terrain, closes with the enemy and overruns the objective. As the platoon is consolidating on the objective and organizing its position, the FIST member calls for indirect fire at the remnants of the enemy to prevent them from reorganizing and launching a counterattack. Throughout the exercise, the FIST member uses standard procedures to ask for and adjust fire. The infantrymen and tankers react to the simulators as they would to actual artillery. All participants in the exercise gain experience in the use and effects of indirect fire.

e. The effects of indirect fire may be simulated by the following items:

- Simulator, ground burst (ammunition code No.)—a hand thrown device filled with photoflash powder. This simulator emits a whistle, followed by a loud blast and a large puff of gray-white smoke. It is used to represent HE mortar and artillery rounds, fuze quick.

- Simulator, air burst (ammunition code No.)–fired from a Very pistol or M203 grenade launcher. This simulator bursts in midair with a loud blast and a puff of gray-white smoke to represent HE mortar and artillery rounds, fuze time or VT.

- Simulator, hand grenade (ammunition code No.)–a hand thrown device similar to the ground burst simulator without the whistle. It may be used when ground burst simulators are not available.

- Grenade, smoke, HC (ammunition code No.)–used to represent WP or HC mortar and artillery rounds in the adjustment phase of smoke missions.

- Pot, smoke, HC (ammunition code No.)–used to represent WP or HC mortar and artillery round in the fire for effect phase of smoke missions. One smoke pot represents five rounds.

2. Commander's Decisions

In planning for indirect fire in engagement simulation, the commander must:

a. Designate an indirect fire controller (IDFC). This officer or NCO is responsible for all aspects of indirect fire in the exercise, including planning, training, execution and after action review. Specific duties of the IDFC are in paragraph 3.

b. Decide which elements of the indirect fire team (FIST, FDC, FB) are to be used in the exercise. As a minimum, a member of FIST should be assigned to each side. In infantry company-size exercises, organic mortar sections should support their companies. In battalion exercises, organic mortar platoons should support their parent battalions. Participation of field artillery FDCs and FBs is at the discretion of the artillery commander.

c. Decide which module of those shown in Section IV is to be used. Modules A and B are recommended for small (platoon or lower) exercises using limited training areas. Module C is recommended for larger exercises (reinforced platoon and higher) or for training areas large enough to require more than one fire

marker per side. Modules D and E are recommended when FDCs and FBs are played. Module F is for use by a small unit with organic fire support, e.g., armored cavalry platoon.

d. Decide on the available supply rate (ASR) for indirect fire. As a rule of thumb, fifty rounds per platoon per exercise is recommended. The exact mix of HE quick, HE time or VT and smoke is a command decision.

e. Decide on the types and calibers of indirect fire weapons to be simulated. Available simulators depict only one size ground burst and one size air burst. It is easier, therefore, for both controllers and players if only one caliber of indirect fire is played. For larger exercises, e.g., company and battalion, multiple calibers may be played. This necessitates informing the fire marker of the caliber being fired so he can depict the correct effects with his equipment.

3. The Indirect Fire Controller (IDFC)

a. The IDFC should be an officer or NCO experienced in all aspects of indirect fire. He is responsible for the training and activities of all indirect fire controllers, FMCC and fire markers.

b. Before the exercise starts, the IDFC:

- Advises the commander on indirect fire play.
- Receives command guidance on the nature and extent of indirect fire.
- Arranges for the additional soldiers and equipment needed to support the indirect fire portion of the exercise, e.g. fire markers, FMCC, weapons controllers, vehicles, radios, simulators. At Annex A are recommended equipment lists.
- Trains the support personnel in their specific duties and in team work with other support personnel. Procedures are in the various modules in Section II, and in the chapters on the Fire Marker Control Center and the fire marker. Specific training guidelines are in Section V.
- Check on navigational aids for the fire markers. Fire markers need easily recognizable checkpoints both on the ground and on their maps so they can locate themselves and the desired impact points

quickly and accurately. Prominent terrain features in and near the training area may be coded, marked on the fire marker and FMCC maps and used as checkpoints. If desired, artificial checkpoints may be used. These should be placed alongside high speed routes that will probably be used by the fire markers. These artificial checkpoints should be intervisible, sequentially numbered, and plotted on fire marker and FMCC maps.

c. During the exercise, the IDFC monitors all indirect fire play. Since the most critical aspect of indirect fire is the accuracy and speed of the fire markers, the IDFC should place himself where he can supervise their activities. The IDFC takes notes of all significant indirect fire activities.

d. At the conclusion of each exercise, the IDFC collects the fire marker mission sheets (Annex B) and any other documentation used; e.g., DA 4504, Record of Fire. He insures that all fire markers and indirect fire weapons controllers attend the controller debrief and after-action review. During the after-action review, he assists the AAR leader in indirect fire matters, and calls on fire markers and controllers as necessary to clarify any questions on indirect fire simulation.

4. Instructions for Players and Controllers

The following must be included in the training of maneuver players and controllers prior to the exercise:

a. Type(s) of indirect fire weapons to be simulated.

b. Casualty assessment rules for indirect fire. Casualty Tables are at Annex C. Applicable portions? may be extracted, reproduced and issued to controllers as a reference.

c. Method of simulation.

- Fire markers represent incoming rounds. In actual combat, the only warning of incoming indirect fire is the sound or whistle of the projectile. Therefore, players cannot take evasive (moving out of the area) or protective (buttoning up) action upon seeing the fire marker vehicle approach or upon seeing the fire marker throw a simulator. Evasive or protective action is allowed only after the ground burst simulator's whistle starts, the air burst simulator detonates or smoke comes out of grenades or pots. If evasive or protective action is taken early, the controller will declare a direct hit on the vehicle and/or soldiers.

- Fire markers and their vehicles are administrative. They are not to be shot at, chased, blocked, run over, bumped or otherwise harassed.

SECTION II. FIRE MARKER CONTROL CENTER

1. General

A Fire Marker Control Center (FMCC) is required for all exercises that involve multiple observers and/or fire markers. The FMCC is part of the control organization of the exercise. It performs functions similar to those of a Fire Direction Center, i.e., it receives requests for fire, processes the request data into information usable by the fire markers and directs the fire markers to simulate indirect fire landing on the battlefield. A mortar or field artillery FDC can easily learn FMCC procedures in one day.

2. Organization

a. Personnel. The following are required to operate an FMCC:

- Fire marker controller (E-5/E-6, MOS 13E or 11C) operates fire marker control net, receives fire marker data from computers, selects fire marker to conduct mission, sends data to fire marker, operates fire marker location chart, is NCOIC.

- Two computers (E-4/E-5, MOS 13E or 11C). Each computer supports one side, operates the fire net, receives fire requests, computes fire marker instructions, operates firing chart, receives reports from supported unit's fire direction center and firing battery (if present), maintains records of fire.

b. Communications. The computers communicate with all indirect fire elements and controllers on their side, e.g., FIST, FDC, FB. They use a head and chest set to minimize noise and confusion in the FMCC. The fire marker controller communicates with all the fire markers. He uses a hand microphone and a loudspeaker so that the computers can monitor fire marker reports, e.g., SHOT, ROUNDS COMPLETE, etc. If possible, all FMCC radios should have RC-292 antennas.

c. Physical Arrangement. The FMCC may be established in an M577 track, a van, or a tent. It should be located near the REALTRAIN Net Control

Station to facilitate coordination. Within FMCC, the two computers should be located on either side of the fire marker controller. Sufficient room must be provided for three charts.

3. Procedures

a. Initial Data

(1) Computer receives fire request over the fire request net, initiates DA Form 4504 (paragraph 4 below). He plots the target on his firing chart, computes the initial commands for the fire marker and enters these commands in the 4504.

- If the observer sends the target location by grid coordinates and the fire markers are also working by grid coordinates, fire marker commands consist of the grid coordinates plus any deviation from the standard one ground burst simulator, e.g., GRID 098645, AIR BURST, or GRID 765437, SMOKE GRENADE or GRID 843522, FIRE FOR EFFECT.

- If the observer sends the target by shift from preplanned target and the fire markers are working by coordinates, the computer plots the shift on his chart, measures the coordinates of the target and enters these as fire marker commands, along with any deviation from the standard one ground burst simulator. Example, observer sends: SHIFT AA201, DIRECTION 4200, RIGHT 250, ADD 400. Computer plots the shift with a target grid (FM 23-91, page 11-21, paragraph 11-12e, or FM 6-40, page 16-10, paragraph 16-19e), and reads target coordinates as 256799. He enters these as Fire Marker Commands.

- If the observer sends the target location by either grid coordinates or shift from preplanned target and the fire markers are working from checkpoints, the computer plots the initial target location, checks with the fire marker controller as to which checkpoint should be used, and measures the direction and distance from that checkpoint to the initial target location. If the Grid-Magnetic angle of the area is more than five degrees, the computer must apply it because the fire marker uses a lensatic compass. The adjusted direction and distance are entered as fire marker instructions. Examples:

  – Observer sends, ADJUST FIRE, GRID 796444. Computer plots target, shows plot to fire marker controller, who selects Checkpoint 5. Computer measures direction and distance from

Checkpoint 5 to target as 48 degrees and 500 meters. The G-M correction is -9 degrees. Instructions to fire marker are, FROM CHECKPOINT 5, DIRECTION 39, DISTANCE 500.

– Observer sends, SHIFT AX 202, DIRECTION 3600, RIGHT 200, ADD 300. Computer plots the shift with target grid, shows plot to fire marker controller, who selects checkpoint DOG. Computer plots direction and distance from checkpoint DOG to target as 280 degrees and 500 meters. G-M correction is -4 degrees. Instructions to fire marker are, FROM DOG, DIRECTION 280, DISTANCE 500.

b. Subsequent Rounds in Adjustment.

(1) After spotting the first round of a fire mission, the observer will send a lateral (right/left) and a range (add/drop) correction to move the round to the target. These corrections will be in reference to the Observer-Target (O-T) direction. The FMCC must convert these corrections to data (direction and distance from previous round) that the FM can use to mark the next round. There are two ways to perform the conversion, by using the M10/M17 plotting board or by plotting on a map. The use of the M10/M17 plotting board is the preferred procedure, as it is much faster and more accurate than map plot.

(2) M10/M17 Plotting Board.

PROCEDURE	EXAMPLE
(a) The center of the plotting board always represents the last round.	Observer sees round, sends: DIRECTION 3550, RIGHT 200, ADD 400.
(b) The O-T direction is placed opposite the red arrow at the top of the plotting board.	Place 3550 (outer scale) opposite red arrow. (Figure 1)
(c) Any convenient scale may be used. For most missions, a scale of one (1) small square equals 20 meters allows sufficient room on the plotting board for computations.	Computer decides to use scale of one (1) small square = 20 meters.
(d) Plot the correction on the board.	Computer measures 10 small squares right and 20 small squares add, marks plot with penciled dot and circle. (Figure 2)
(e) Lay a straight edge from center of board through plot and note azimuth.	Azimuth is 4020 mils. (Figure 3)

FIGURE 1

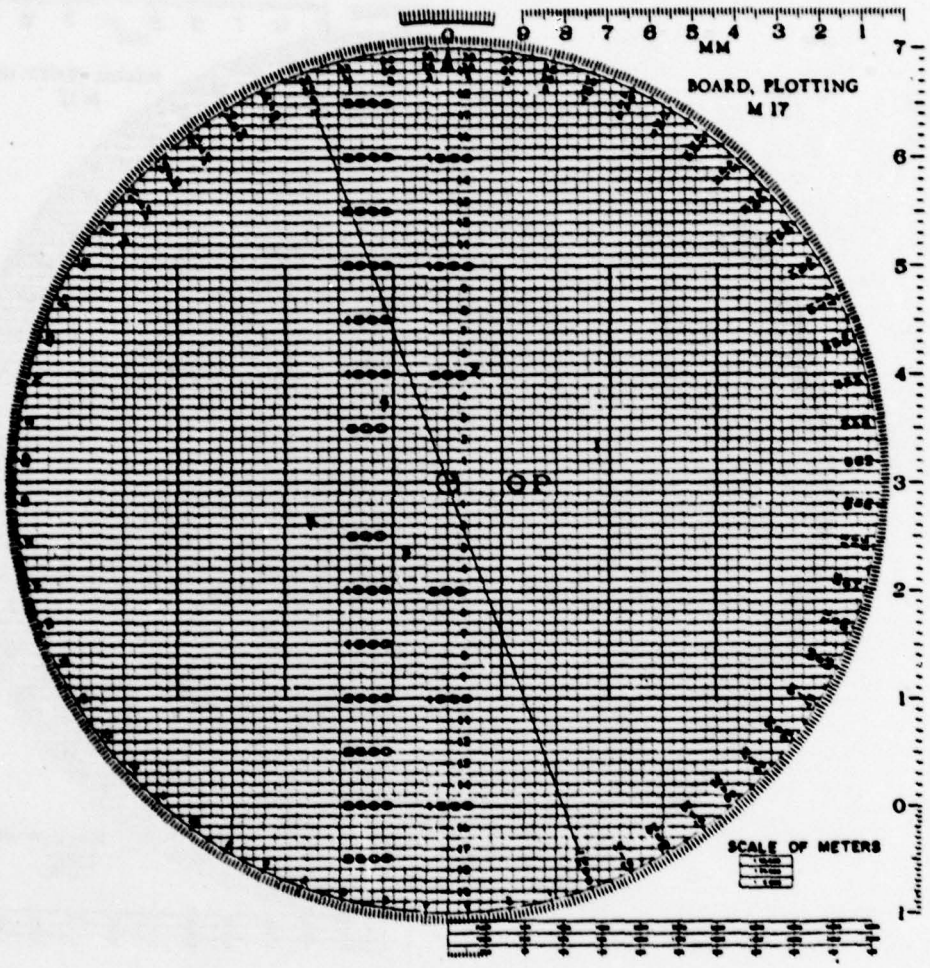


FIGURE 2

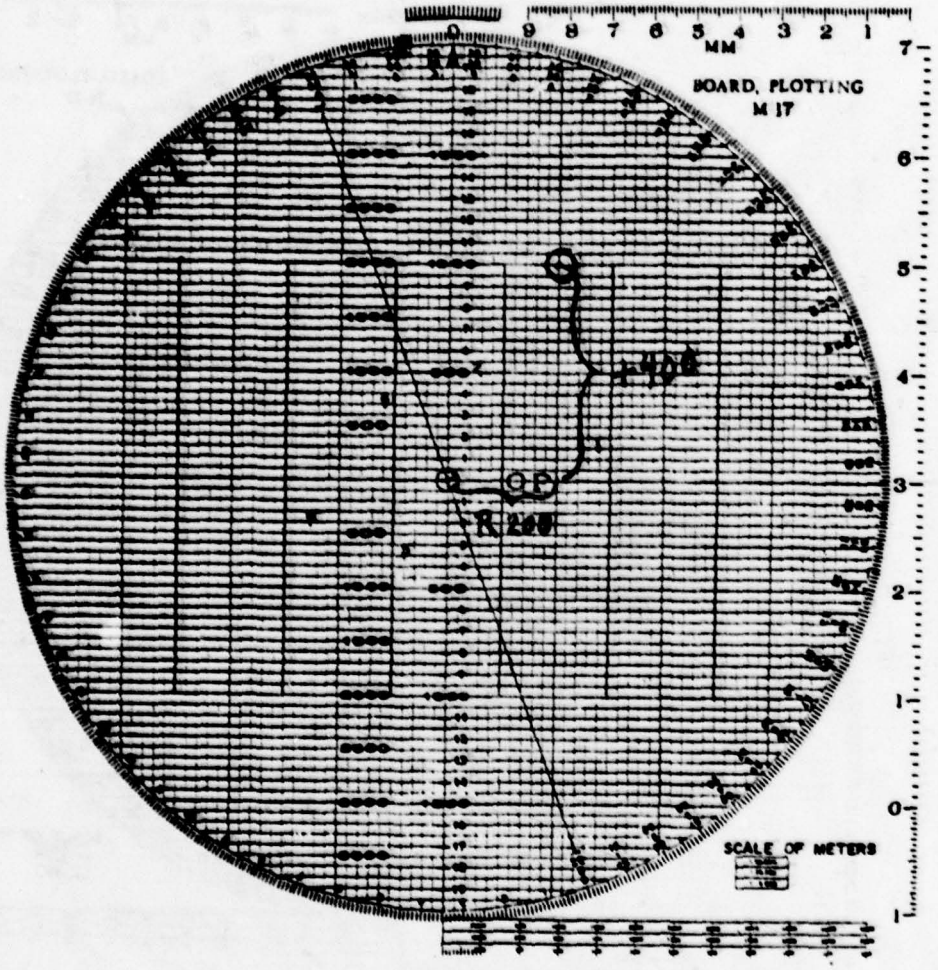


FIGURE 3

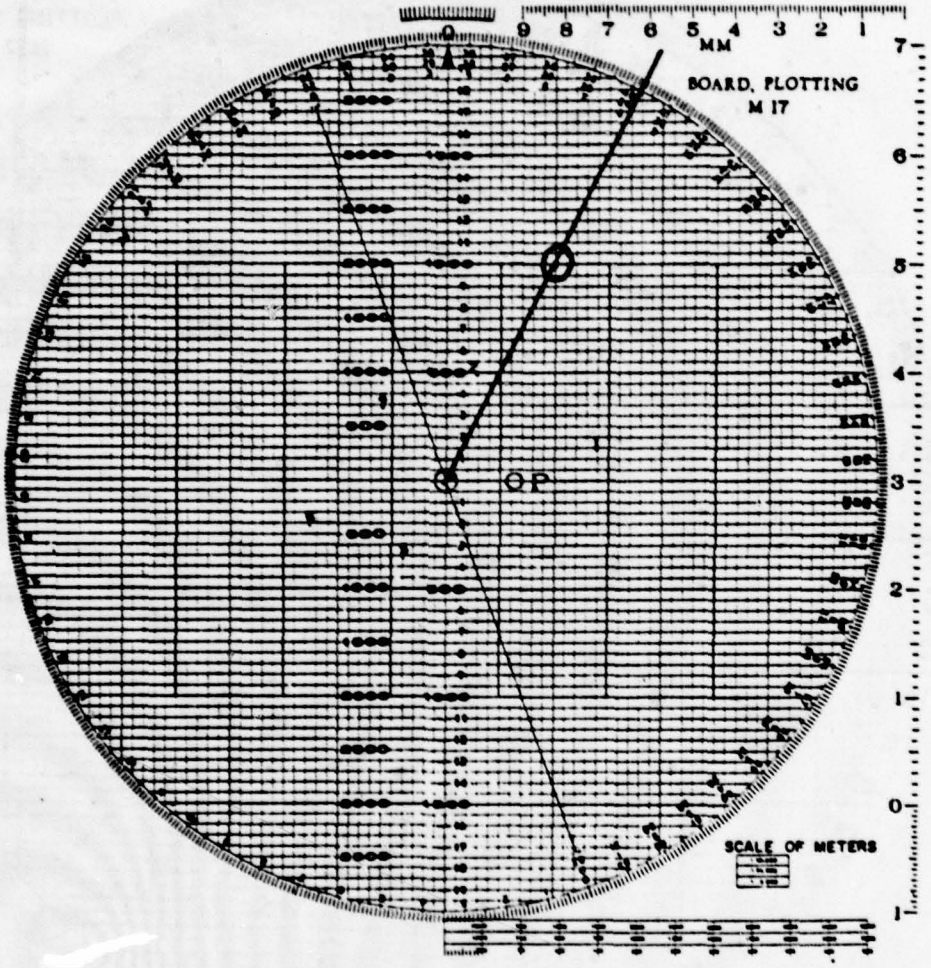
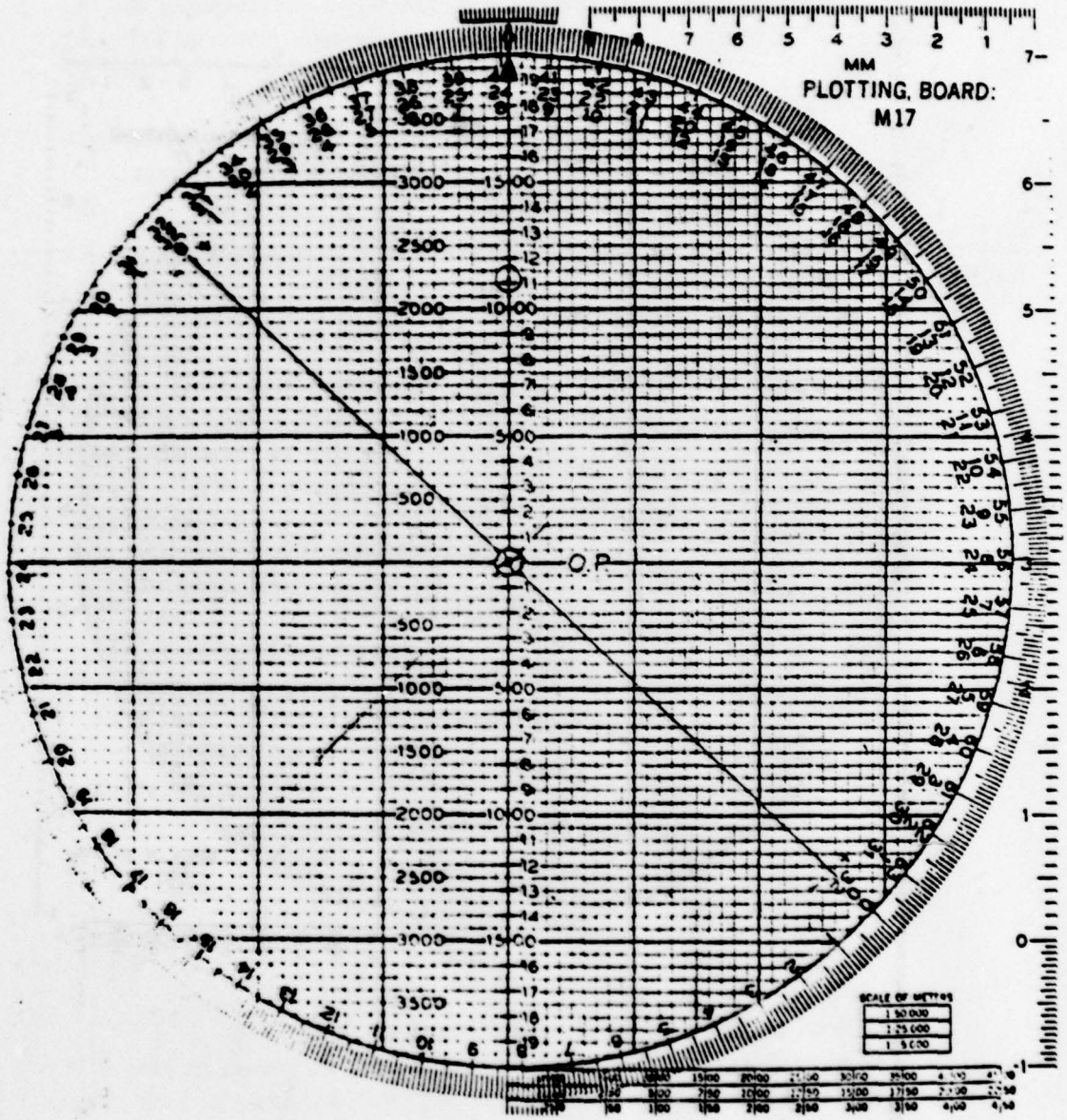


FIGURE 4



PROCEDURE	EXAMPLE
(f) Using mil-degree conversion table, (Annex D) change azimuth to degrees.	4000 mils = 225 degrees 4100 mils = 231 degrees By interpolation, 4020 mils = 226 degrees.
(g) If Grid-Magnetic (G-M) angle is significant (5 degrees or more), apply it.	Refer to marginal notes of map. For this map sheet, to convert from grid to magnetic, subtract 15 degrees. 226 - 15 = 211.
(h) Rotate disc of plotting board until plot is on a horizontal or vertical line that intersects the center of the board. Count the squares from center of board to plot and to determine distance.	Rotate disc until plot is on vertical line that intersects center of board. (Figure 4) Count 22 small squares. 22 x 20 = 440 = distance in meters.
(i) Send fire marker direction and distance from last round that he has to travel to mark observer's desired correction.	BLUE, DIRECTION 211, DISTANCE 440, OVER.
(j) Repeat procedure for subsequent corrections. Rember, center of board is always last round fired. If observer does not send lateral correction, plotting board is not required. See paragraph (4) below.	

(3) Map Plot. This procedure is used when the M10/M17 Plotting Board is not available. It requires a map or grid sheet, protractor and coordinate square.

PROCEDURE	EXAMPLE
(a) Mark initial target location.	Target is at 094664. (Figure 5)
(b) Record O-T direction and observer correction.	Observer spots first round, sends, DIRECTION 2500, LEFT 200, ADD 400.
(c) Refer to mil-degree conversion table, change mils to degrees.	2500 mils = 141 degrees
(d) With protractor, draw a line from initial target location in O-T direction.	With protractor centered on initial target plot, draw line at 141 degrees. (Figure 6)

PROCEDURE	EXAMPLE
(e) With coordinate square, measure observer correction from initial target location along O-T direction. Plot adjusted location.	Measure 400 meters along line and 200 meters left of line. Be sure to maintain O-T orientation. (Figure 7)
(f) With protractor, measure azimuth from initial target location to adjusted location.	With protractor centered on initial target plot, measure azimuth to adjusted target plot as 117 degrees (Figure 8)
(g) If G-M angle is more than 5 degrees, correct for it.	Refer to marginal notes on map. For this map sheet, to convert from grid to magnetic, subtract 12 degrees. 117 - 12 = 105
(h) With coordinate square, measure distance from initial target location to adjusted target location.	Measured distance is 440 meters. (Figure 9)
(i) Send fire marker direction and distance from last round that he must travel to mark observer's desired correction.	RED, DIRECTION 105, DISTANCE 440, OVER.
(j) Repeat procedure for subsequent corrections, always plotting from last round marked. If observer does not send any lateral corrections, plotting is not necessary. See paragraph below.	

(4) Adjustments Without Lateral Corrections.

(a) Adjustments without lateral (left/right) corrections, e.g., ADD 400, DROP 200, can be computed without use of the plotting board or a map plot.

(b) To compute an ADD correction, convert the O-T direction to degrees, correct for G-M angle if necessary, and send the direction and distance to the fire marker. EXAMPLE: O-T direction is 1500 mils; G-M angle is -15 degrees. Observer sends ADD 200. 1500 mils = 84 degrees. 84 - 15 = 69. Tell fire marker, DIRECTION 69, DISTANCE 200.

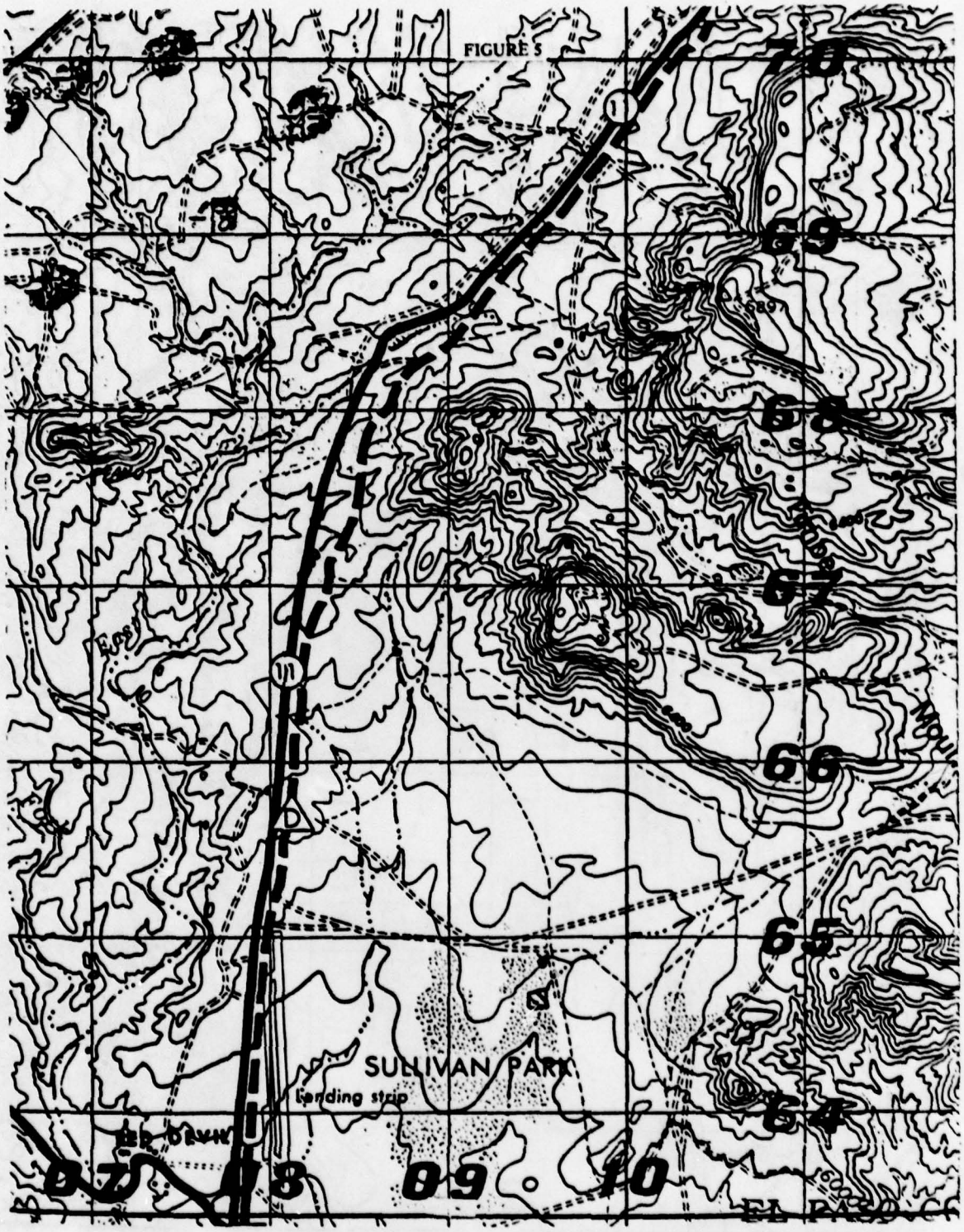


FIGURE 5
SULLIVAN PARK
Landing strip
EL PASO
68
69
70
67
66
65
64
111

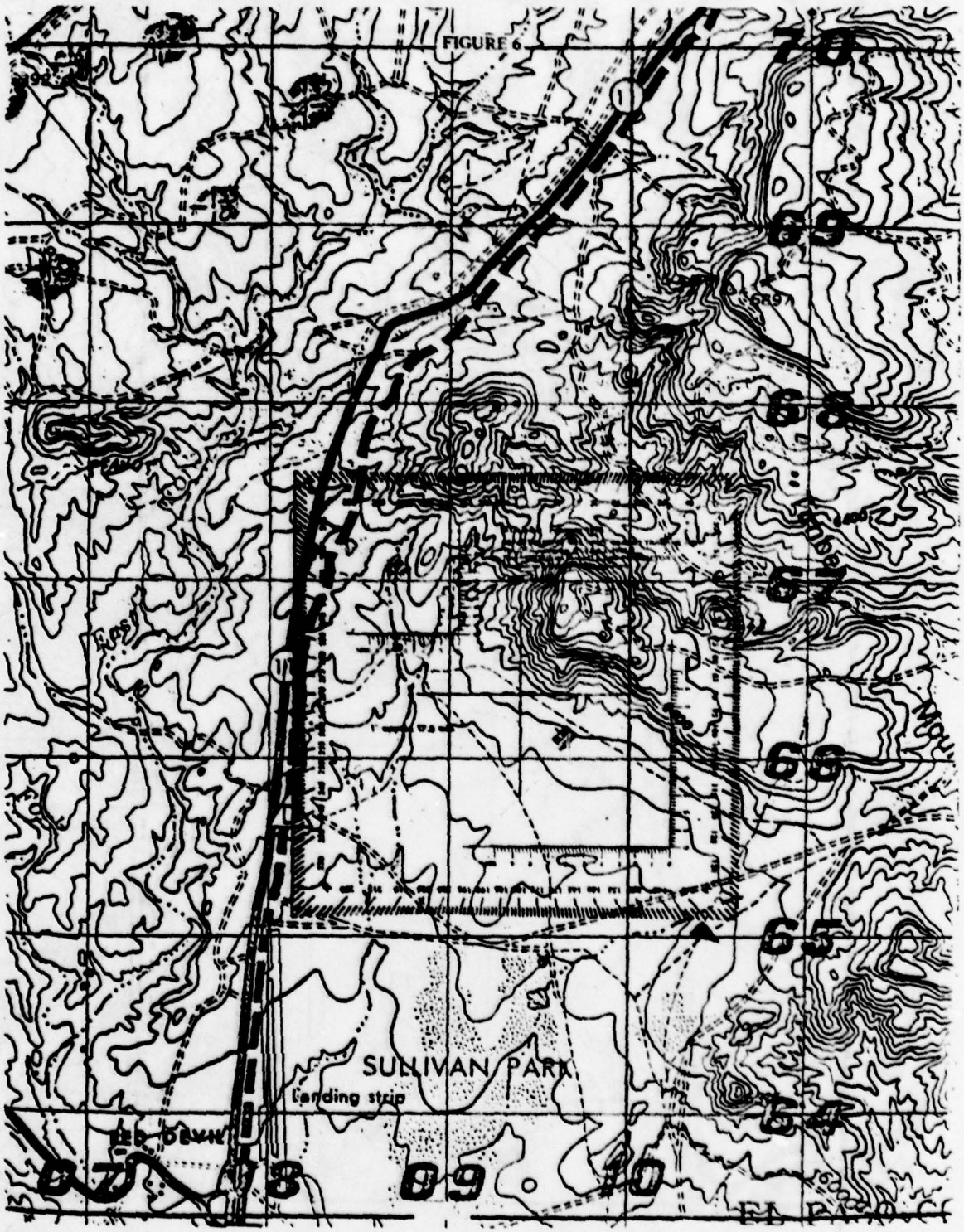


FIGURE 6

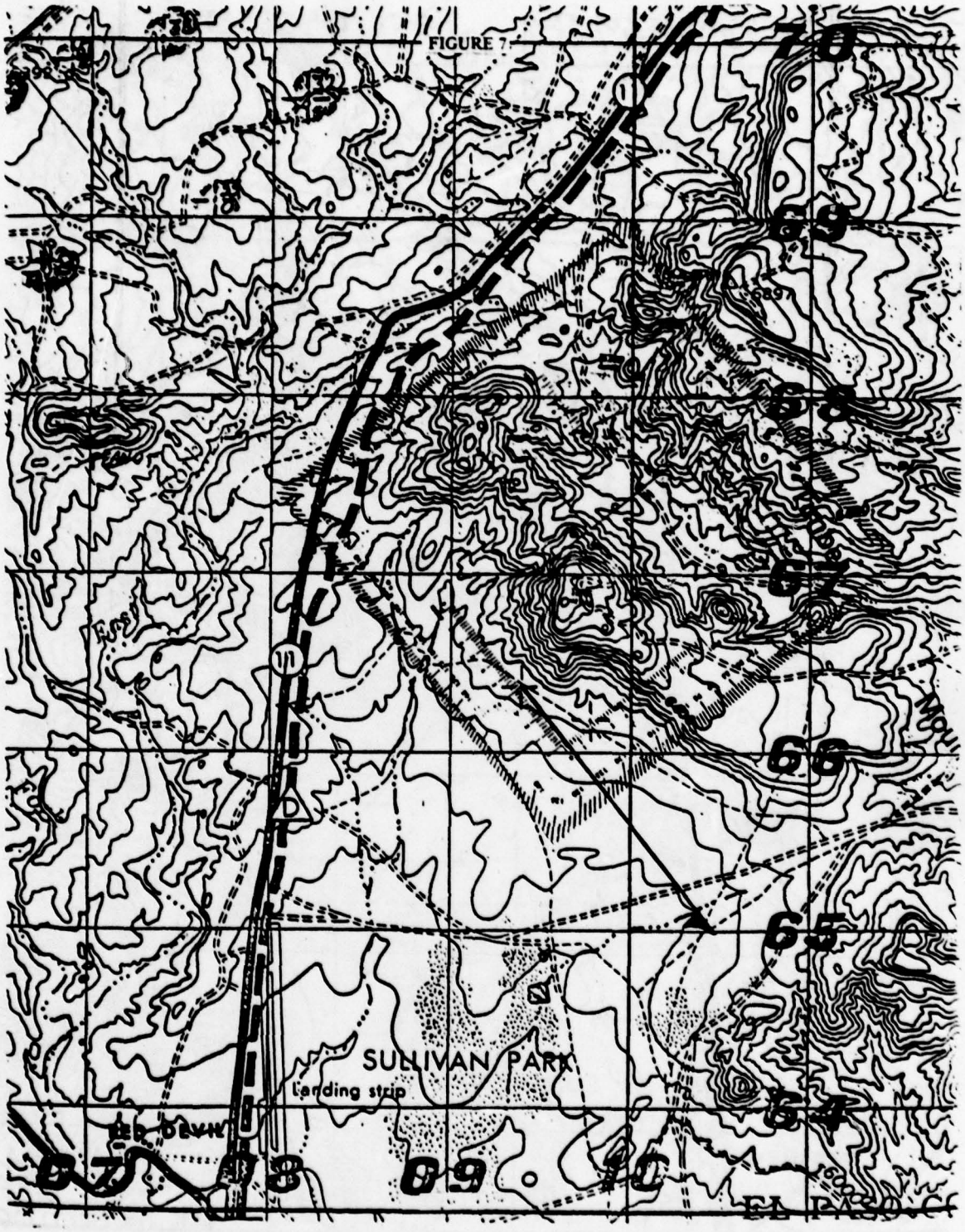


FIGURE 7

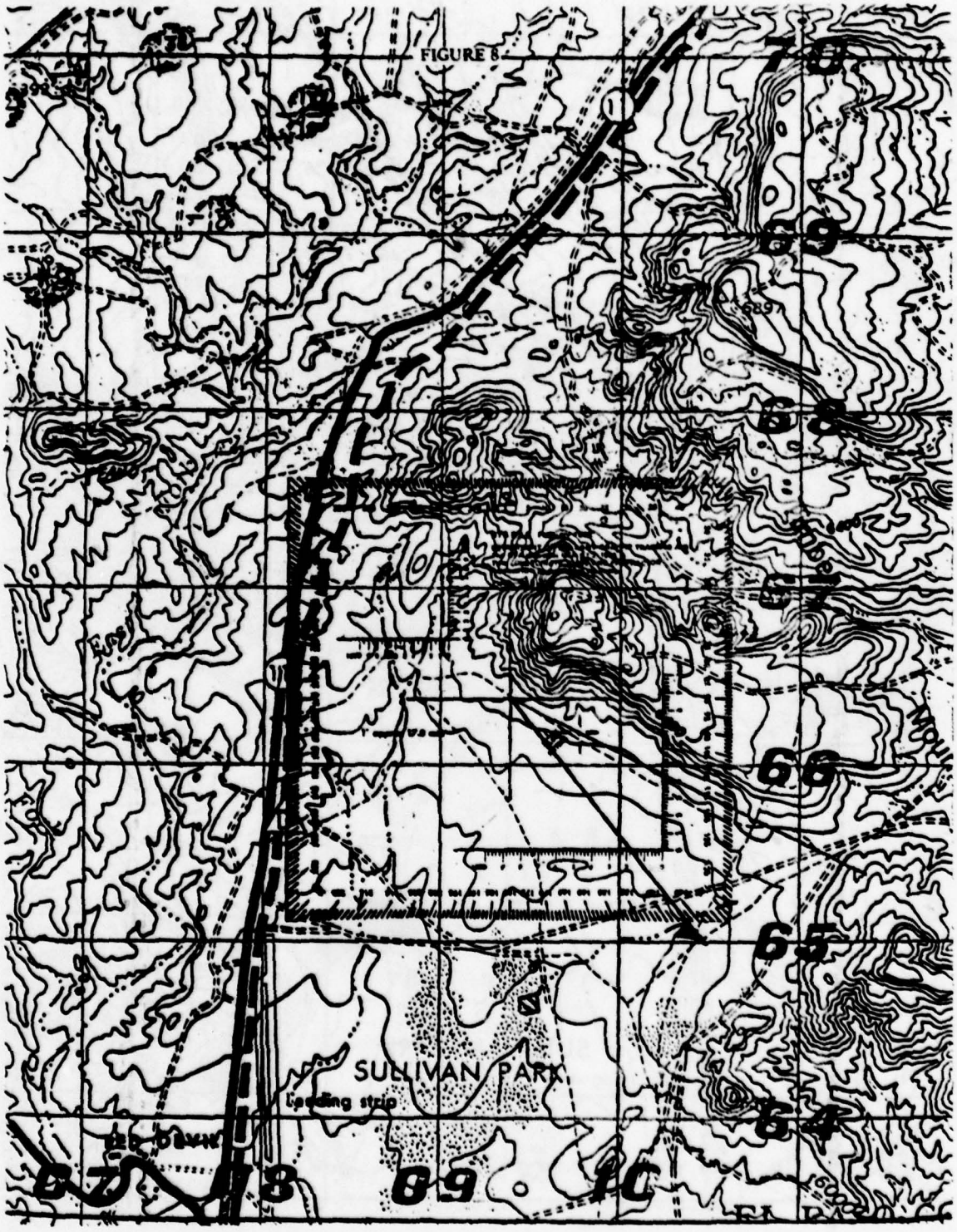


FIGURE 8

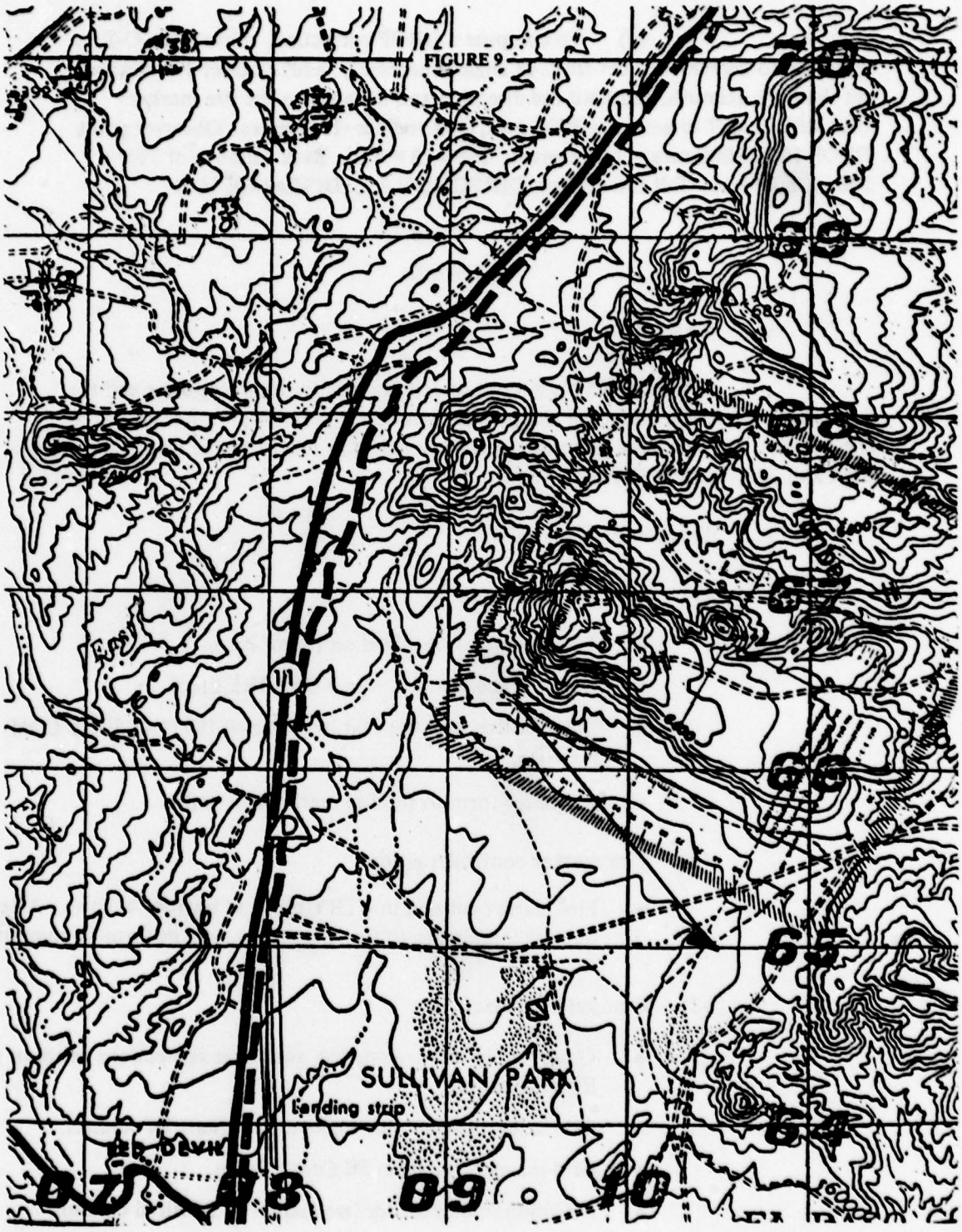


FIGURE 9

(c) To compute a DROP correction, convert the O-T direction to degrees, correct for G-M angle if necessary, add/subtract 180 degrees to get the back azimuth, and send the direction and distance to the fire marker. EXAMPLE: O-T direction is 3000 mils; G-M angle is -13 degrees. Observer sends DROP 100. 3000 mils = 169 degrees. 169 - 13 = 156. Back azimuth of 156 = 156 + 180 = 336. Tell fire marker, DIRECTION 336, DISTANCE 100.

4. Records

a. General

DA Form 4504, Record of Fire, is used by the computers and the fire marker controller to record and pass information to each other. At the end of the exercise, the forms are given to the senior controller for use in the Controller Debrief and After-Action Review.

b. Procedure (Figure 10)

(1) Computer enters:

- Time mission is received on top of form.
- Observer request in CALL FOR FIRE block.
- Data for fire marker in Sp Instr line of INITIAL FIRE COMMANDS.

He then passes form to the fire marker controller.

(2) Fire marker controller enters:

- Fire marker callsign in BTRY block at bottom of form. After sending initial data to fire marker, he returns form to computer.

(3) Computer enters:

- Observer direction, deviation and range corrections in columns on left side of form.
- Grid azimuth from plotting board in Chart Df column.
- Grid-magnetic angle in Df Corr column.
- Direction in degrees for fire marker in Df Fired column.
- Distance for fire marker in QE column.

He then passes form to fire marker controller.

(4) Fire marker controller sends distance and direction to fire marker, maintains simulator count in AMMO columns, and returns form to computer.

(5) When observer request fire for effect, computer enters FFE in MF, Sh, Chg, Fz column.

(6) Fire marker controller enters casualty assessment in blank box at bottom of form and time "end of mission" is received after DTG.

FIGURE 10

TIME RECEIVED: 1005 — RECORD OF FIRE

Observer FIREBALL 25	CALL FOR FIRE (AF) FFE/IS/S	Tgt TOW
Grid 098695		
Polar: Dir ___ Dis ___ U/D ___ VA ± ___		
Shift ___ : Dir ___ L/R ___ +/- ___ U/D ___		
REQUEST TIME FUZE		

Δ FS	
100/R	
/R	
20/R	
HOB Corr	
Si	
El	
QE	

+Si÷10 | 10 of Si | Df Corr | Chl Df | Df

FIRE ORDER

INITIAL FIRE COMMANDS | FM | MF | Rg

Sp Instr F_R CP 5, D/R 39, D/S 500 | Sh A/R | Lot | Chg | Fz | Ti | Df | QE

MTO | ↑T | PE_R | TF | in Eff | Ammo Exp [illegible] AIR

Tgt	Location	Priority	Firing Unit	SUBSEQUENT FIRE COMMANDS											AMMO	
Dir, MF Sh, Fz	Dev	Rg	HOB Corr	MF, Sh Chg, Fz	FS Corr	Ti	Chart Df	Df Corr (−15)	Df Fired	Chart Rg	HOB Corr	Si	El	QE	Exp	Type
3550	R200	+400					[illegible]	-15	211					440	[illegible]	AIR
	L100	-200					[illegible]	-15	33					220	[illegible]	"
		+100					[illegible]	-15	185					100	[illegible]	"
		-50 FFE		FFE			[illegible]/20	-15	5					50	[illegible]	"

TOW 65 DESTROYED, 4 CREW KIA

Btry BLUE	DTG 1030	Tgt	Replot Grid	Replot Alt

DA FORM 1 MAY 78 4504 — Replaces DA Form 3022, 1 Jan 74 and DA Form 4007, 1 Jan 73, which are obsolete.

For use of this form, see FM 6-40 and FM 6-40-5; the proponent agency is US Army Training and Doctrine Command.

SECTION III. FIRE MARKERS

1. General

a. Quick and accurate fire marking is the keystone of effective indirect fire simulation. Fire marker teams are composed of two soldiers, the fire marker and the vehicle driver. The fire marker must be an excellent map reader, able to locate himself and the target location quickly and to determine the quickest route to the target. Possible sources of fire markers are members of FIST (MOS 13F) and members of the scout section (MOS 11D) of the divisional armored cavalry squadron or the scout section of the battalion combat support company. The fire marker driver must be skilled in cross-country driving and must be able to operate a radio. Fire markerse normally use ¼-ton trucks. Other vehicles, e.g., M113 APC, may, however, be used.

b. The number of fire marker teams needed for a specific exercise depends on:

- Troop availability.
- Terrain. Training areas that are heavily cross-compartmented, have bad trafficability (sand, mud, ice), or otherwise impede high speed travel necessitate more fire marker teams than open, rolling terrain with good road nets.
- Transportation. The better the transportation available, the less the number fire markers needed.
- Training. Fire markerse who can accurately and consistently locate grid coordinates can cover a larger area than fire markers who must first go to a checkpoint, then proceed on an azimuth for a given distance.
- Technology. Current simulators must be hand delivered or fired short distances. Development of a "shootable" simulator with a 300 meter range will allow fire markers to cover larger areas.
- Time available. The norm is for a fire marker team to deliver the initial simulator within four minutes after receipt of target location.

Subsequent adjusting rounds should be delivered within two minutes for shifts of between 200 and 400 meters and within one minute for shorter distances. If the commander is willing to accept longer delivery times, the number of fire marker teams can be decreased.

2. Basic Procedures

a. Fire markers may receive target locations in:

- grid coordinates, or
- shift from known point
  - with Observer-Target (OT) direction, lateral (right/left) and range (add/drop) changes, or
  - with azimuth and distance.

b. Fire missions may be:

- Fire for Effect. This will be indicated by the words, "FIRE FOR EFFECT," "IMMEDIATE SUPPRESSION," or "SUPPRESS" in the fire request. This means that no further adjustment is necessary. The fire marker is to go to the location and, if the mission is HE, mark the center and four corners of the fire for effect pattern (page 33). If the mission calls for smoke, he ignites a smoke pot.

- Adjustment. This is any fire request that does not ask for "FIRE FOR EFFECT," "IMMEDIATE SUPPRESSION," or "SUPPRESS." It means that the observer is not quite sure of the target location and wishes to adjust rounds until he is sure that he can hit the target. The fire marker fires one artillery simulator or pops one smoke grenade (HC) per round in adjustment. At the end of the adjustment, the observer will shift into fire for effect.

c. In all missions, the fire marker must:

- Read back all fire requests exactly as received.
- Record data on mission sheet (Annex B).
- Proceed to target location by fastest safe route.
- When within 200 meters of target, transmit callsign and SHOT, OVER.

- When troops and/or vehicles are within the casualty producing area of a simulator, switch the radio to control channel and assess casualties by transmitting the REALTRAIN numbers and the nature of the casualties twice, e.g. "APC 25 DESTROYED, 2 CREW KILLED BY ARTILLERY... APC 25 DESTROYED, 2 CREW KILLED BY ARTILLERY." Immediately switch back to fire marker frequency and again announce the casualties.
- At end of each mission, fire marker places his vehicle under nearest concealment and waits for next mission.

3. Specific Procedures

a. Initial Round

(1) Target given by grid coordinates. Fire marker records coordinates on mission sheet under "Target Location," proceeds to location and delivers simulator(s).

(2) Target given as shift from known point, with O-T direction and lateral and range change. The following is keyed to Figures 11 to 14. Known point A1 is crossroads at coordinates 559791 (Figure 11).

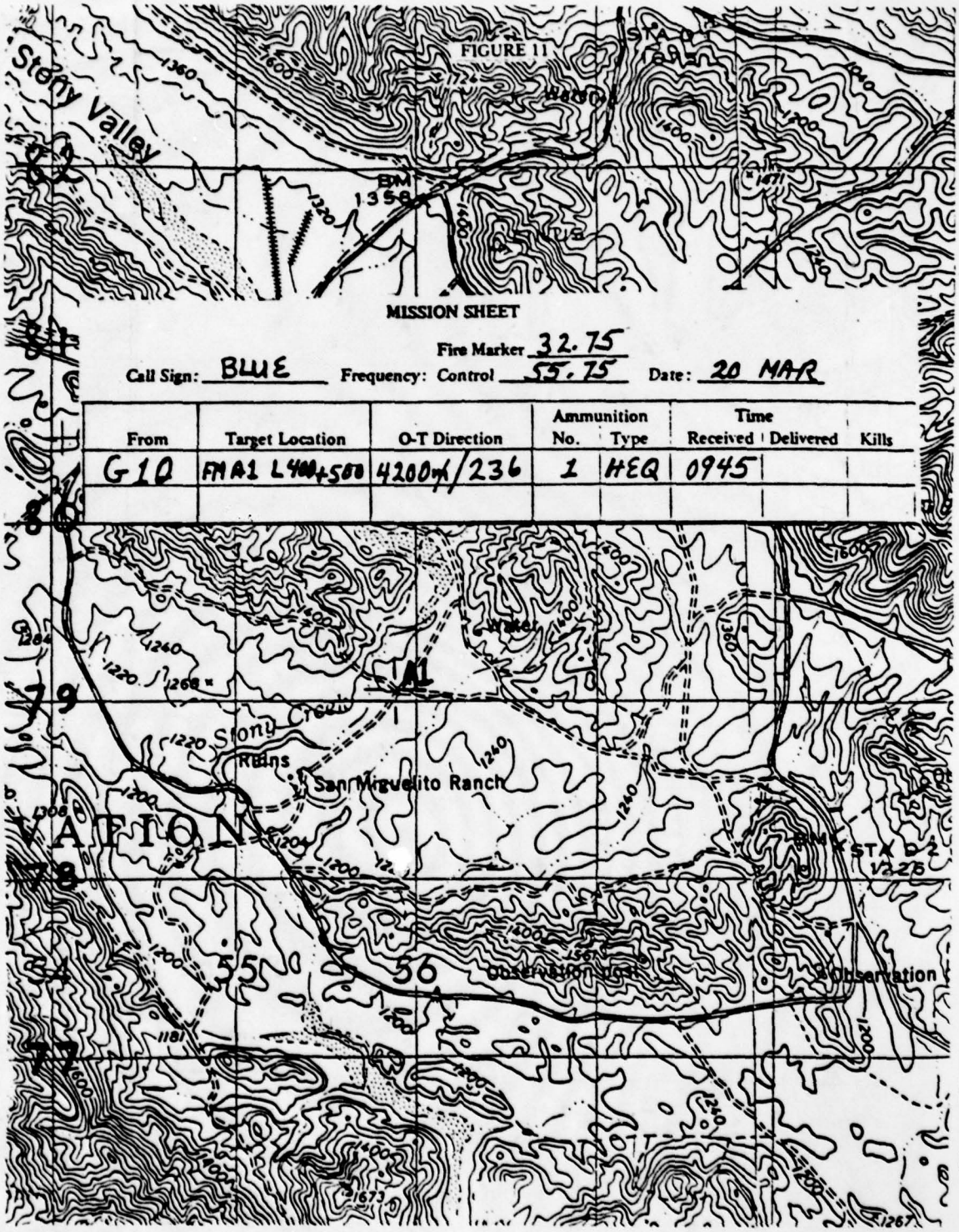
PROCEDURE:	EXAMPLE:
(a) Observer sends fire request over fire net, using standard fire request format.	FIST: BLUE, THIS IS G10, SHIFT TARGET A1, OVER. FM: G10, THIS IS BLUE, SHIFT TARGET A1, OUT. FIST: DIRECTION 4200, LEFT 400, ADD 500, TOW POSITION, OVER. FM: DIRECTION 4200, LEFT 400, ADD 500, TOW POSITION, OUT.

PROCEDURE	EXAMPLE
(b) Fire marker records request on mission sheet (Annex B) and plots target location, using protractor and coordinate square.	Fire marker enters observer call sign, target location and O-T direction in first three columns of mission sheet as: G10, FM A1 L400+500, 4200. He uses mils to degrees conversion table (Annex D) to change 4200 mils to 236 degrees. (Figure 12). With the protractor centered on A1, he plots an azimuth of 236 degrees and places an arrowhead at the point of the ray. (Figure 13) With coordinate square, he measures 400 meters left and 500 meters add from A1, using the arrowhead to stay oriented on the proper right/left and add/drop. (Figure 14) He plots this spot and reads the grid coordinates of the target as 557785.

(3) Target given as shift from known point, with azimuth and distance. The following is keyed to Figure 15. Checkpoints for fire markers are marked every 100 meters along the road from 554786 to 562795. Initial target location is at 558792.

PROCEDURE:	EXAMPLE:
(a) FMCC receives fire mission, plots target, measures grid azimuth and distance from nearest checkpoint to target, converts grid to magnetic azimuth by applying GM angle and sends mission to fire marker.	FMCC: RED, THIS IS CONTROL, FIRE MISSION, OVER. FM: CONTROL, THIS IS RED, SEND YOUR MISSION, OVER. FMCC: FROM F, DIRECTION 300, DISTANCE 200, OVER. FM: FROM F, DIRECTION 300, DISTANCE 200.
(b) Fire marker records mission on Mission Sheet (Annex B), shoots the azimuth and estimates the distance. When within 200 meters of target, he transmits: SHOT.	Records Target Location as "From F, Dir 300, Dis 200," enters ammunition and time received, shoots an azimuth of 300 degrees with lensatic compass, estimates 200 meters and proceeds to that spot. FM: RED, SHOT, OVER. FMCC: SHOT, OUT.

FIGURE 11



MISSION SHEET

Fire Marker 32.75

Call Sign: BLUE Frequency: Control 55.75 Date: 20 MAR

From	Target Location	O-T Direction	Ammunition No.	Ammunition Type	Time Received	Time Delivered	Kills
G10	FM A1 L400+500	4200m/236	1	HEQ	0945		

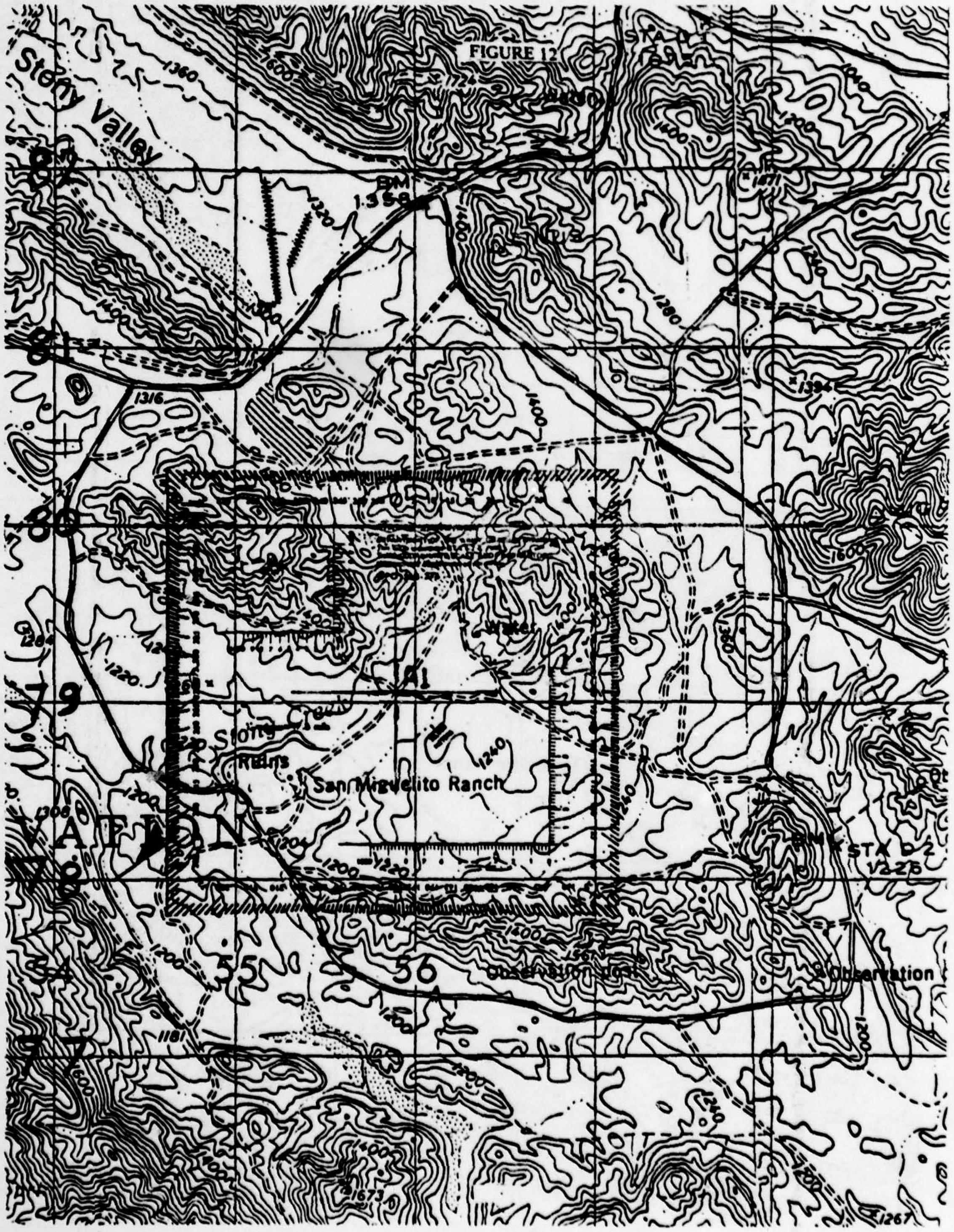


FIGURE 12
Stony Valley
San Miguelito Ranch
Stony Creek
Ruins
Water
Observation
55
56
81
80
79
78
77

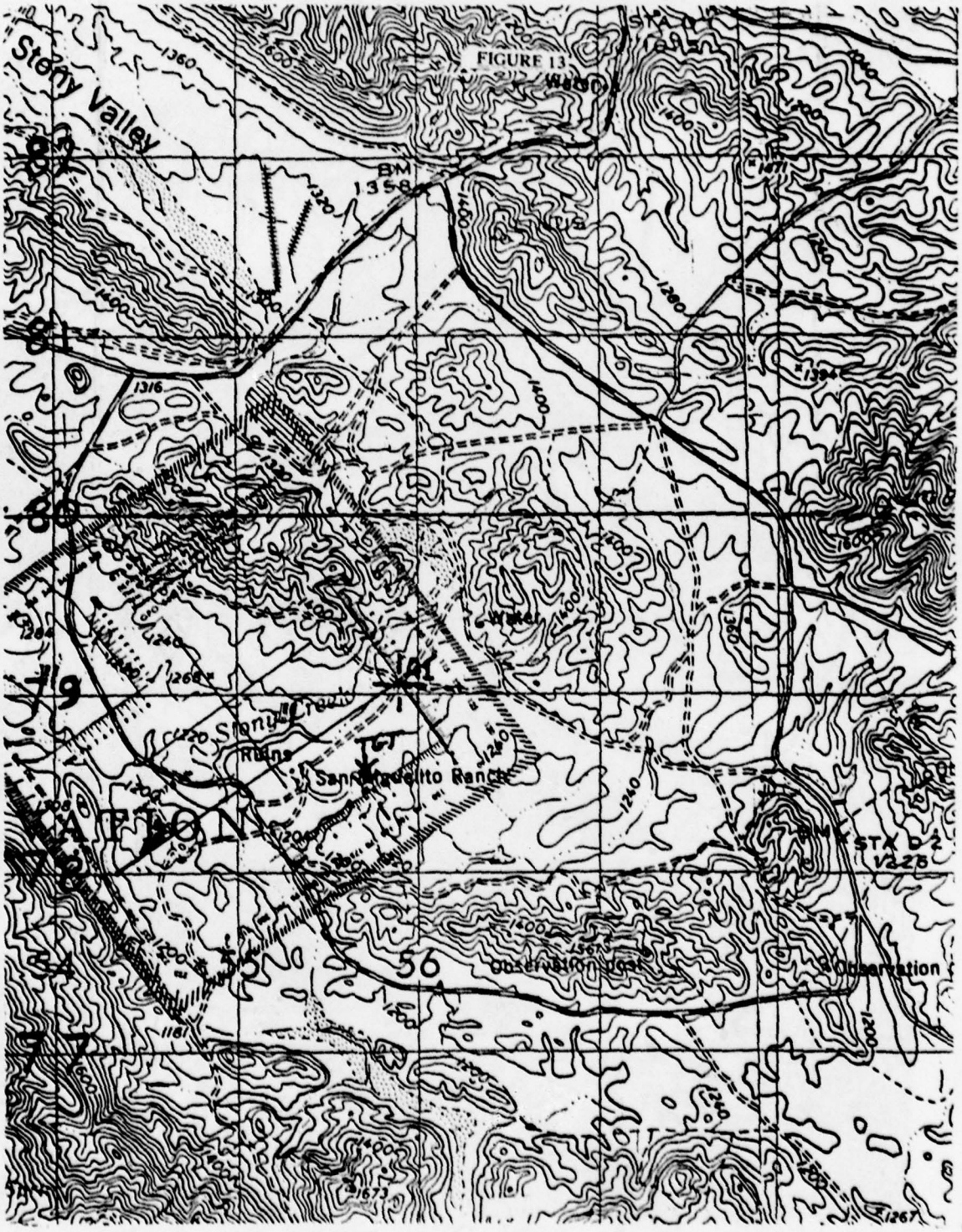

Stony Valley
BM
1358
Stony Creek
Ruins
Observation
Observation
56

FIGURE 13

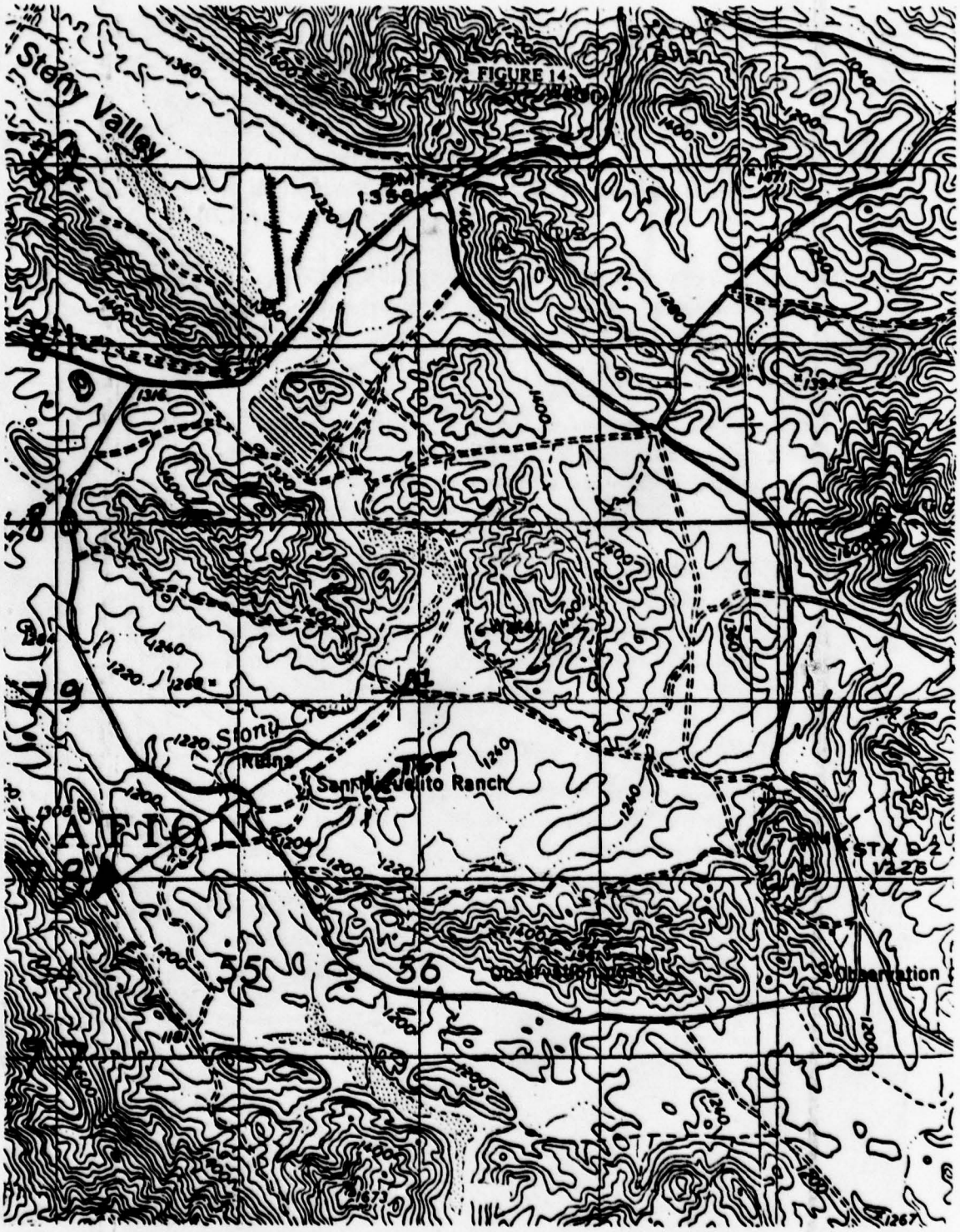

Stony Valley
Stony Creek
Ruins
San Miguelito Ranch
STA D-2
Observation
55
56

FIGURE 14

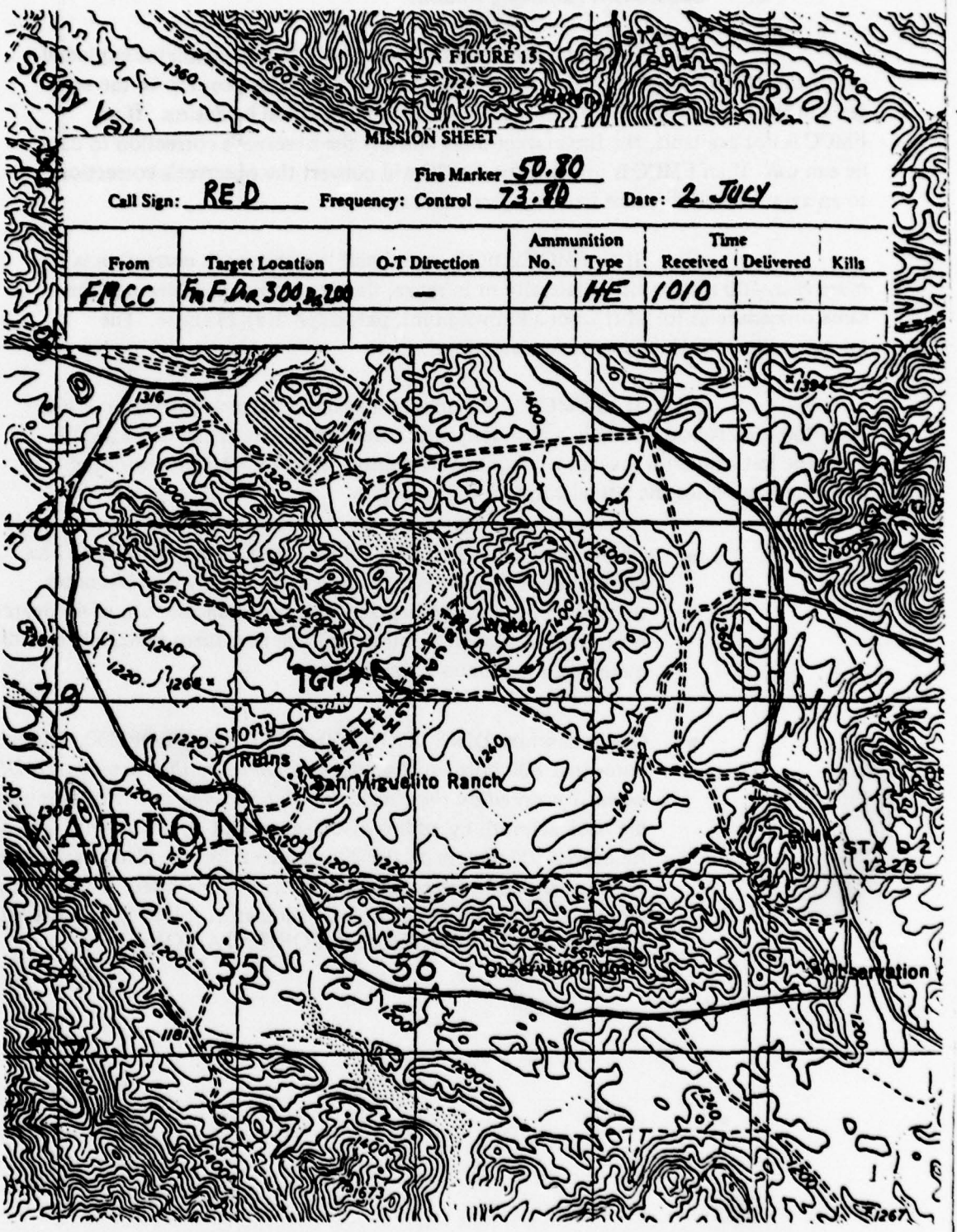
FIGURE 13

MISSION SHEET

Fire Marker 50.80

Call Sign: RED Frequency: Control 73.80 Date: 2 JULY

From	Target Location	O-T Direction	Ammunition No.	Ammunition Type	Time Received	Time Delivered	Kills
FMCC	FnFDn 300,200	—	1	HE	1010		



b. **Subsequent Adjusting Rounds**

(1) To adjust fire from the spot where thelast simulator exploded to the target, the observer must announce the azimuth from his position to the target and the lateral (right/left) and range (add/drop) correction he desires. If an FMCC is not available, the fire marker must convert the observer's correction to data he can use. If an FMCC is present, the FMCC will convert the observer's corrections to an azimuth and distance from the last simulator.

(2) If an FMCC is not present, and the observer's correction is more than 400 meters either laterally or in range, the fire marker goes through the same procedure as for shift from a known point, paragraph 2(a)(2) above. The known point is the location of the last round.

(3) If an FMCC is not present and the observer's correction is less than 400 meters both laterally and in range, the fire marker shoots the O-T azimuth from the last simulator, executes the range correction, makes a 90 degree turn right or left and executes the lateral correction. Examples:

- Observer sends, DIRECTION 800, RIGHT 100, ADD 200. Fire marker refers to mil-degree conversion table (Annex D), notes that 800 mils equal 45 degrees. He shoots an azimuth of 45 degrees from the last simulator, moves 200 meters, turns right, moves 100 meters and detonates a simulator.

- Observer sends, DIRECTION 800, LEFT 100, DROP 200. Observer notes that 800 mils equal 45 degrees. *Because the correction is DROP, he must proceed on the back azimuth of 45 degrees.* He computes the back azimuth by adding 180 degrees and comes up with 225 degrees. He moves 200 meters on the 225 degree azimuth. *Because he is on a back azimuth, the lateral correction must be reversed.* He turns right, moves 100 meters and detonates a simulator. FIRE MARKER MUST REMEMBER THE OBSERVER'S ORIENTATION.

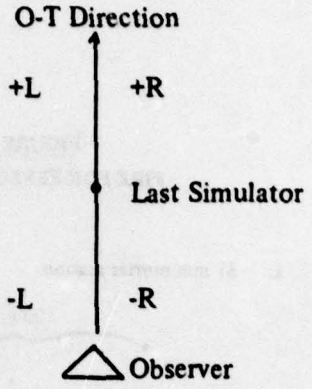


FIGURE 16 . OBSERVER ORIENTATION

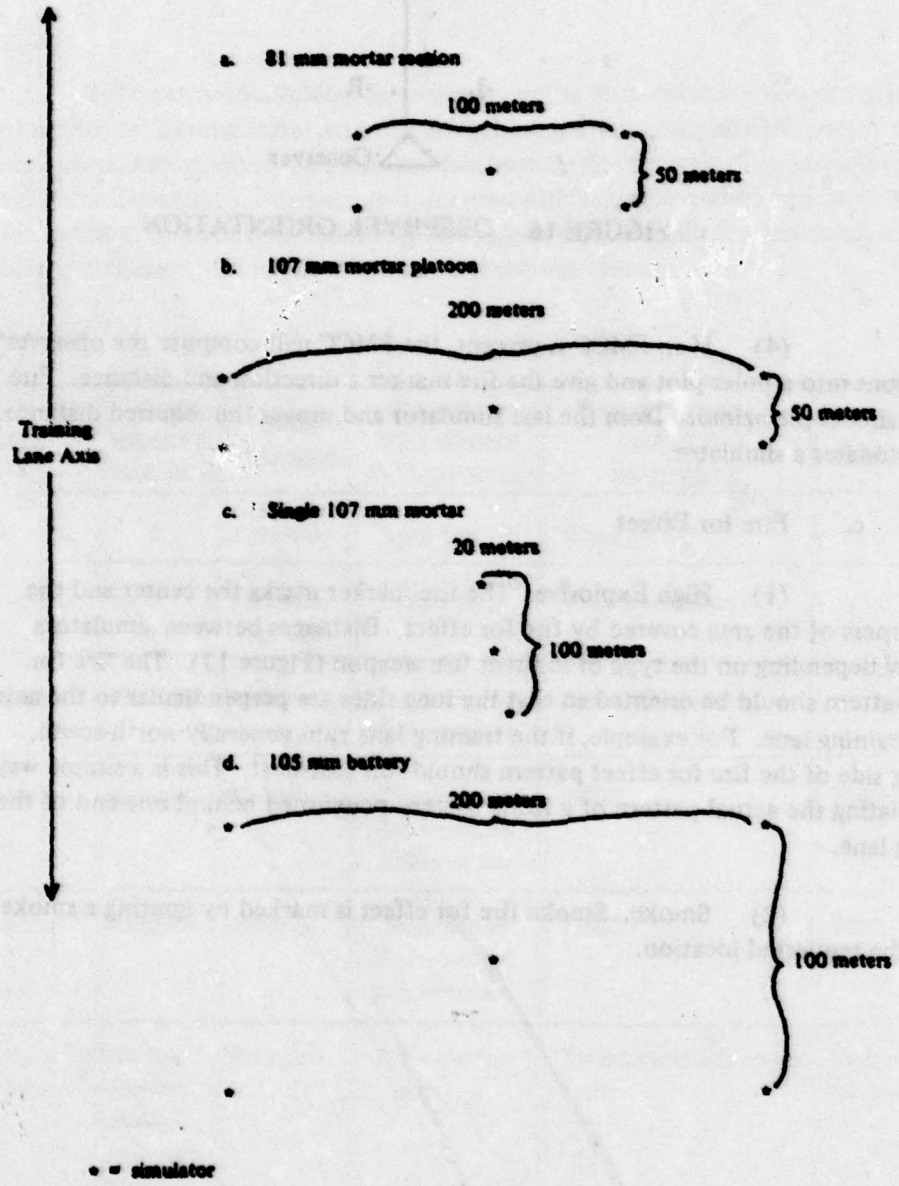
(4) If an FMCC is present, the FMCC will compute the observer's corrections into a polar plot and give the fire marker a direction and distance. Fire marker shoots the azimuth from the last simulator and moves the required distance, then detonates a simulator.

c. Fire for Effect

(1) High Explosive. The fire marker marks the center and the four corners of the area covered by fire for effect. Distances between simulators will vary depending on the type of indirect fire weapon (Figure 17). The fire for effect pattern should be oriented so that the long sides are perpendicular to the axis of the training lane. For example, if the training lane runs generally north-south, the long side of the fire for effect pattern should run east-west. This is a simple way of simulating the actual pattern of a firing battery positioned behind one end of the training lane.

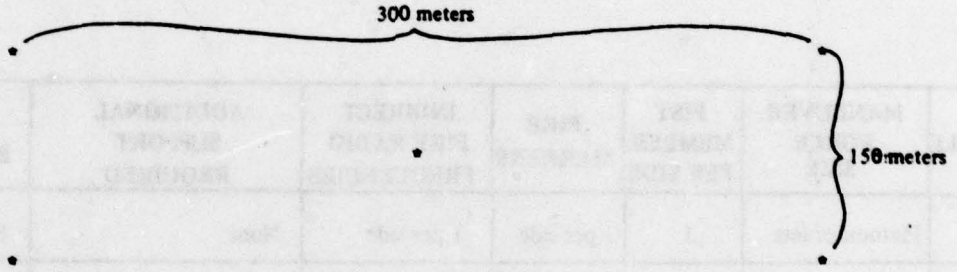
(2) Smoke. Smoke fire for effect is marked by igniting a smoke pot at the requested location.

FIGURE 17
FIRE FOR EFFECT PATTERNS



FIRE FOR EFFECT PATTERNS (Continued)

e. 155 mm battery



SECTION IV. SIMULATION MODULES

Introduction

Different modules have been developed to fit various combinations of unit size, number of fire markers, size of training area, participation of FDC and FB. Commanders should select the modules that best fit their needs. Two modules may be used simultaneously. For example, in a two-sided exercise covering a large training area with only one operational FDC being played, a combination of modules C and D may be used. The following matrix describes the modules:

MODULE	MANEUVER FORCE SIZE	FIST MEMBER PER SIDE	FIRE MARKERS	INDIRECT FIRE RADIO FREQUENCIES	ADDITIONAL SUPPORT REQUIRED	INDIRECT FIRE ELEMENTS PLAYED
A	Platoon or less	1	1 per side	1 per side	None	None
B	Platoon team	1	1 per side 4 sq. KM	1 per side	1 IDFC per side	FDC (optional)
C	Platoon and above	Multiple	Multiple	2 fire request 1 fire marker	FMCC (3 soldiers)	None
D	Platoon and above	Multiple	Multiple	2 fire request 2 fire control 1 fire marker	FMCC	FDC
E	Company and above	Multiple	Multiple	2 fire request 2 fire control 1 fire marker	FMCC	FDC FB
F	Armored Cavalry Platoon/Infantry Company	Multiple (May be cavalry scout sections)	Multiple	2 fire marker nets	2 mortar controllers per side	Organic mortar section(s)

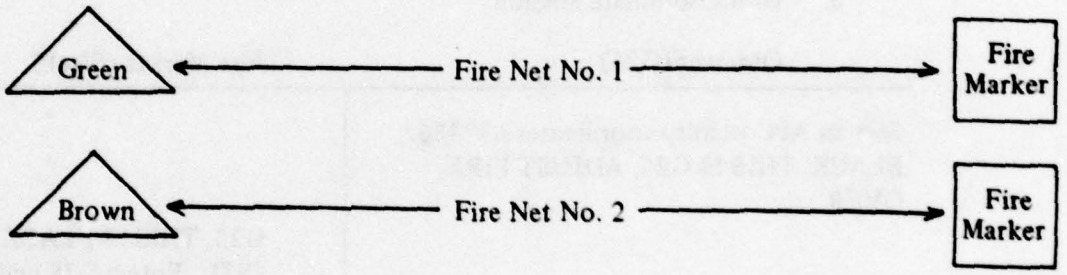
Module A: Observer and Fire Marker

1. General.

This module is recommended for use in small (platoon or lower) exercises in limited training areas where only one FIST member and one fire marker for each side is required. If no FIST is available, any soldier may request fires. IDFC may act as one fire marker. For equipment, see Annex B.

2. Communications.

Each side and fire marker are linked by one radio frequency.



3. Fire Planning.

a. FIST member attends unit leader's tactical briefing and assists leader in planning fires. Each side is allowed one pre-planned target.

b. FIST member or unit leader gives fire marker coordinates of pre-planned target. Fire marker initially positions himself in nearest concealed location to pre-planned target. If no pre-planned target is announced, fire marker positions himself at end of training area opposite from the element he is supporting.

4. Procedure.

a. Any member of the unit with access to a radio may get on the fire frequency and call for fire, subject to unit SOP. If a FIST member is present, he is the primary fire requester.

b. Fire requests are sent by standard format, c.f. FM 6-40.5, 1 July 1976, Chapter 5. Target location may be given by grid coordinates or by a shift from pre-planned target. Target location can NOT be given by polar plot or by shift from a previously planned mission, as the fire marker does not have the equipment or training to compute these.

c. At the end of the exercise, the IDFC/senior fire marker collects the Mission Sheets (Annex B) and turns them over to the senior controller for use in the After-Action Review. Both fire markers attend the Controller Debrief and the After-Action Review.

5. Illustrative Examples.

a. Grid Coordinate Mission

Observer (G25)	Fire Marker (Black)
Sees an APC vicinity coordinates 637456. BLACK, THIS IS G25, ADJUST FIRE, OVER.	
	G25, THIS IS BLACK, ADJUST FIRE, OUT. Enters G25 under "From and Time Received" on Mission Sheet.
GRID 637456, OVER.	
	GRID 637456, OUT. Enters coordinates under target location.
APC, OVER.	
	APC, OUT. As no special ammunition requests or fire for effect have been sent, enters 1 HE in ammunition column. Plots target location on map and proceeds to that location by fastest route.
	When about 200 meters from target, BLACK, SHOT, OVER.
SHOT, OUT. Prepares to observe simulator.	
	Detonates simulator at target location.
DIRECTION 1600, RIGHT 100, ADD 200, OVER.	
	DIRECTION 1600, RIGHT 100, ADD 200, OUT. Refers to mils-degrees conversion table (Annex D), changes 1600 to 90 degrees. Enters 1600/90 under O-T direction, R 100+200 under target location,

Observer (G25)	Fire Marker (Black)
	and 1 HE under ammunition. Measures azimuth of 90 degrees from last simulator, moves 200 meters, turns right, moves 100 meters. En route, sends BLACK, SHOT, OVER.
SHOT, OUT. Prepares to observe simulator.	
	Detonates simulator upon arrival at new location.
DROP 100, FIRE FOR EFFECT.	
	DROP 100, FIRE FOR EFFECT. Enters–100, FFE under target location, 5 HE under ammunition. Because correction is DROP, computes back azimuth of O-T direction by adding 180 (90+180 = 270). Shoots azimuth of 270 degrees, moves toward new location. SHOT, OVER.
SHOT, OUT. Prepares to observe fire for effect.	
	After traveling 100 meters, marks fire for effect pattern. After detonating last simulator, sends ROUNDS COMPLETE, OVER.
ROUNDS COMPLETE, OUT. Observes target area, END OF MISSION, APC DESTROYED.	
	END OF MISSION, APC DESTROYED. Sees APC 39 within effects radius of fire for effect, switches radio to control channel. APC 39 DESTROYED, 2 CREW KILLED BY ARTILLERY, APC 39 DESTROYED, 2 CREW KILLED BY ARTILLERY. Switches radio back to fire frequency, places vehicle in nearest concealed position.

b. Shift from pre-planned target. The following is keyed to Figures 18 to 22. Pre-planned target B1 is road junction at coordinates 541803 (Figure 18).

Observer (B26)	Fire Marker (White)
WHITE, THIS IS B26, SHIFT B1, OVER.	
	B26, THIS IS WHITE, SHIFT B1, OUT.
DIRECTION 345 DEGREES, LEFT 400, ADD 400, SAGGER, OVER.	
	DIRECTION 345 DEGREES, LEFT 400 DROP 400, SAGGER, OUT. (Fig. 19) Enters fire request on mission sheet. (Fig. 20) Draws an arrow from target B1 at azimuth 345 degrees. Because shift includes a drop, extends arrow below B1. (Fig. 20) Measures 400 meters short of and 400 meters
	left of B1 along azimuth line and (Fig. 22) plots Sagger at coordinates 538798. Proceeds to this location by fastest route. When about 200 meters from it, sends: WHITE, SHOT, OVER.
SHOT, OUT. Prepares to observe simulator.	
	Upon arrival at 538798, detonates simulator.
RIGHT 100, ADD 200, OVER.	
	RIGHT 100, ADD 200, OUT. Enters data on Mission Sheet. Shoots azimuth of 345 degrees with compass, proceeds 200 meters, makes 90 degree right turn, proceeds 100 meters. En route, sends: WHITE, SHOT, OVER.
SHOT, OUT. Prepares to observe simulator.	
	Detonates simulator at new location.
DROP 100, FIRE FOR EFFECT, OVER.	
	DROP 100, FIRE FOR EFFECT, OUT. Records data, computes back azimuth of 345 (345 - 180) as 165. As he is within 200 meters, sends: SHOT, OVER.
SHOT, OUT. Observes target area.	
	Moves on azimuth 165 for 100 meters, marks fire for effect pattern. After last simulator is thrown, sends: ROUNDS COMPLETE, OVER.
ROUNDS COMPLETE, OUT. Sees simulator explode near target. END OF MISSION, SAGGER DESTROYED, OVER.	

Observer (B26)	Fire Marker (White)
	END OF MISSION, SAGGER DESTROYED, OUT. Observes TOW APC 18 in fire for effect casualty area, switches to control frequency, sends: TOW APC 18 DESTROYED, 4 CREW KILLED BY ARTILLERY, TOW APC 18 DESTROYED, 4 CREW KILLED BY ARTILLERY. Switches back to fire frequency; positions vehicle under nearest available concealment and waits for next mission. Complete Mission Sheet is at Figure 23.

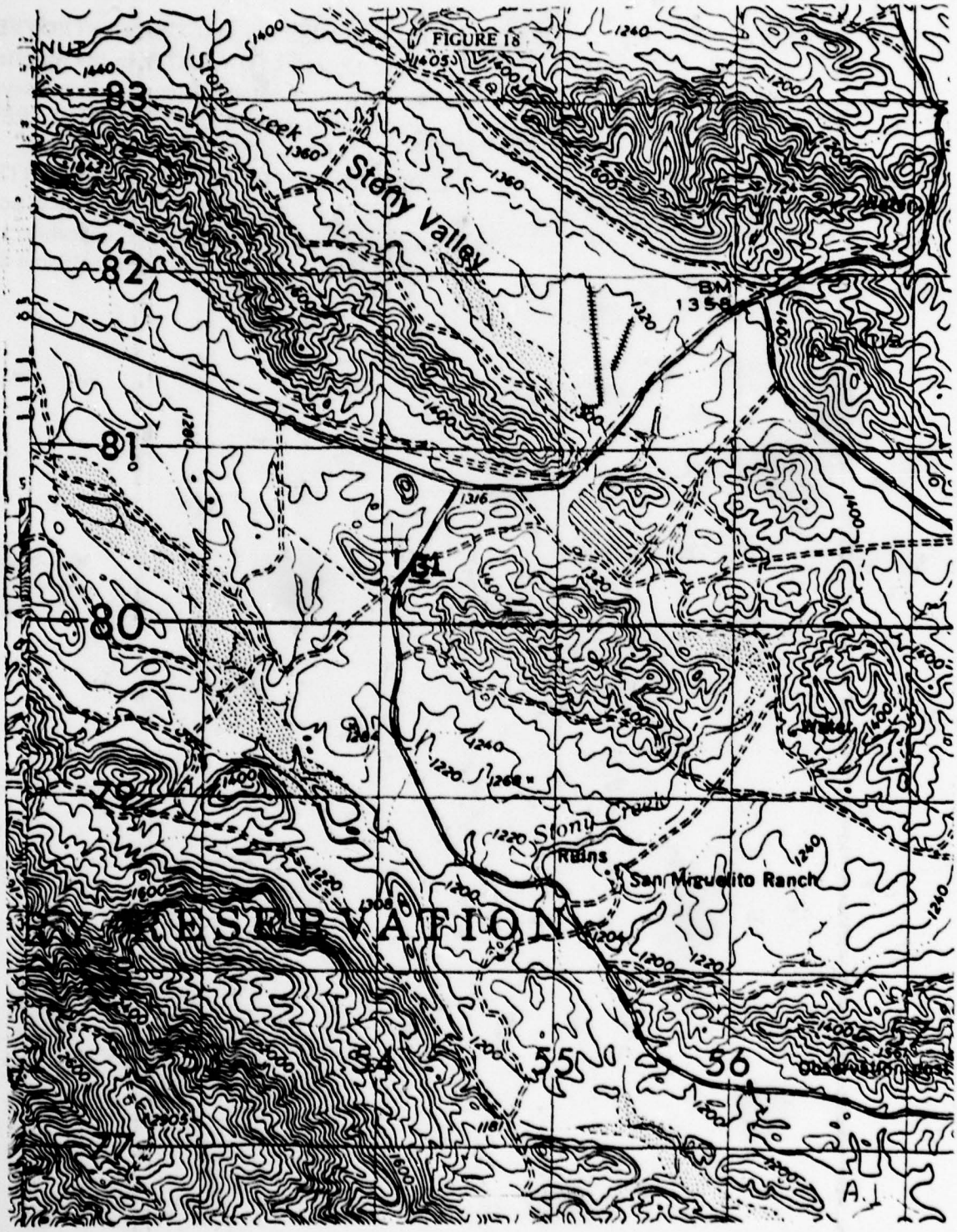


FIGURE 18
Stony Creek
Stony Valley
BM
1358
Stony Creek
Ruins
San Miguelito Ranch
RESERVATION
83
82
81
80
79
78
77
54
55
56
51

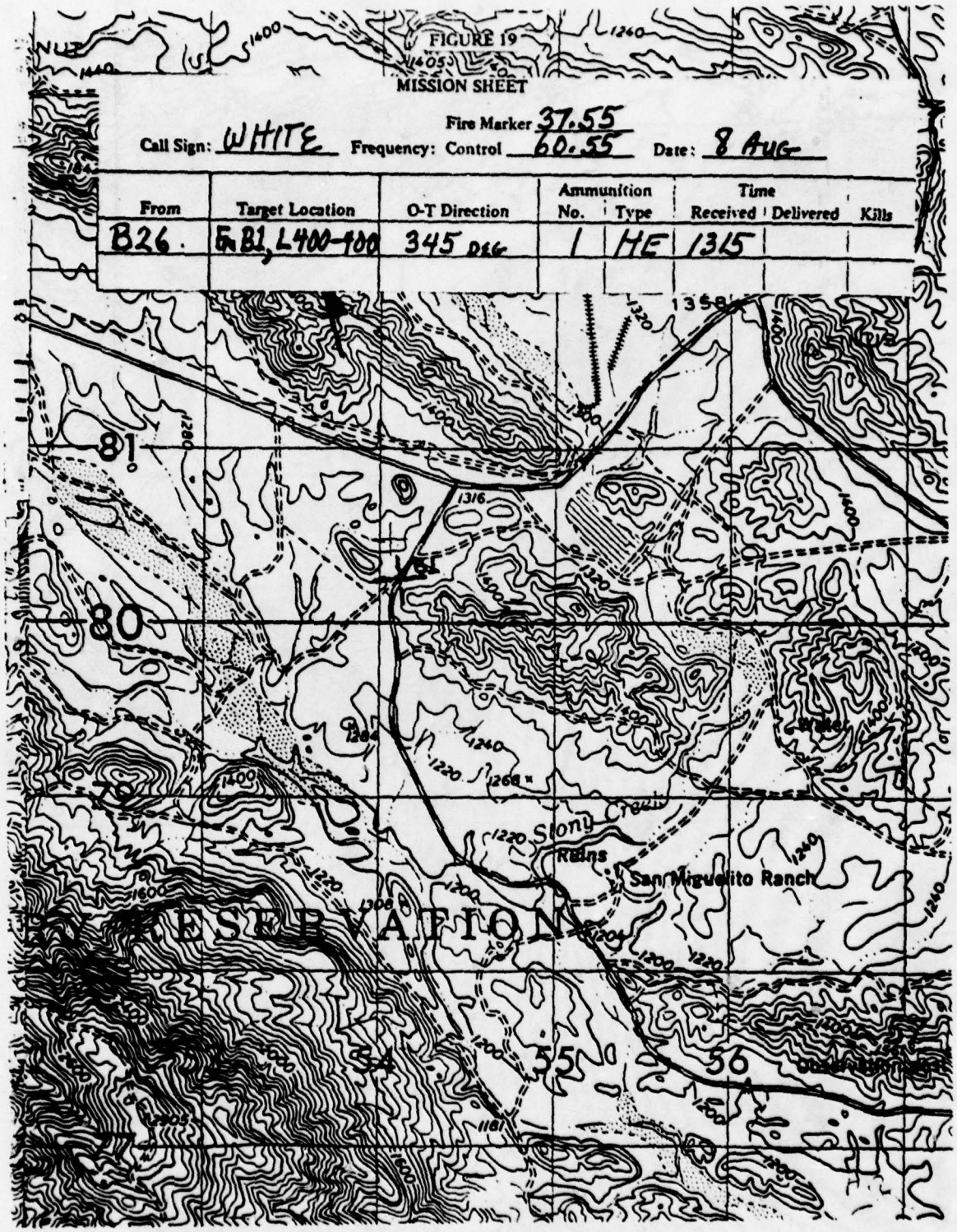
FIGURE 19

MISSION SHEET

Fire Marker 37.55

Call Sign: WHITE Frequency: Control 60.55 Date: 8 AUG

From	Target Location	O-T Direction	Ammunition No.	Ammunition Type	Time Received	Time Delivered	Kills
B26.	En B1, L400-400	345 DEG	1	HE	1315		



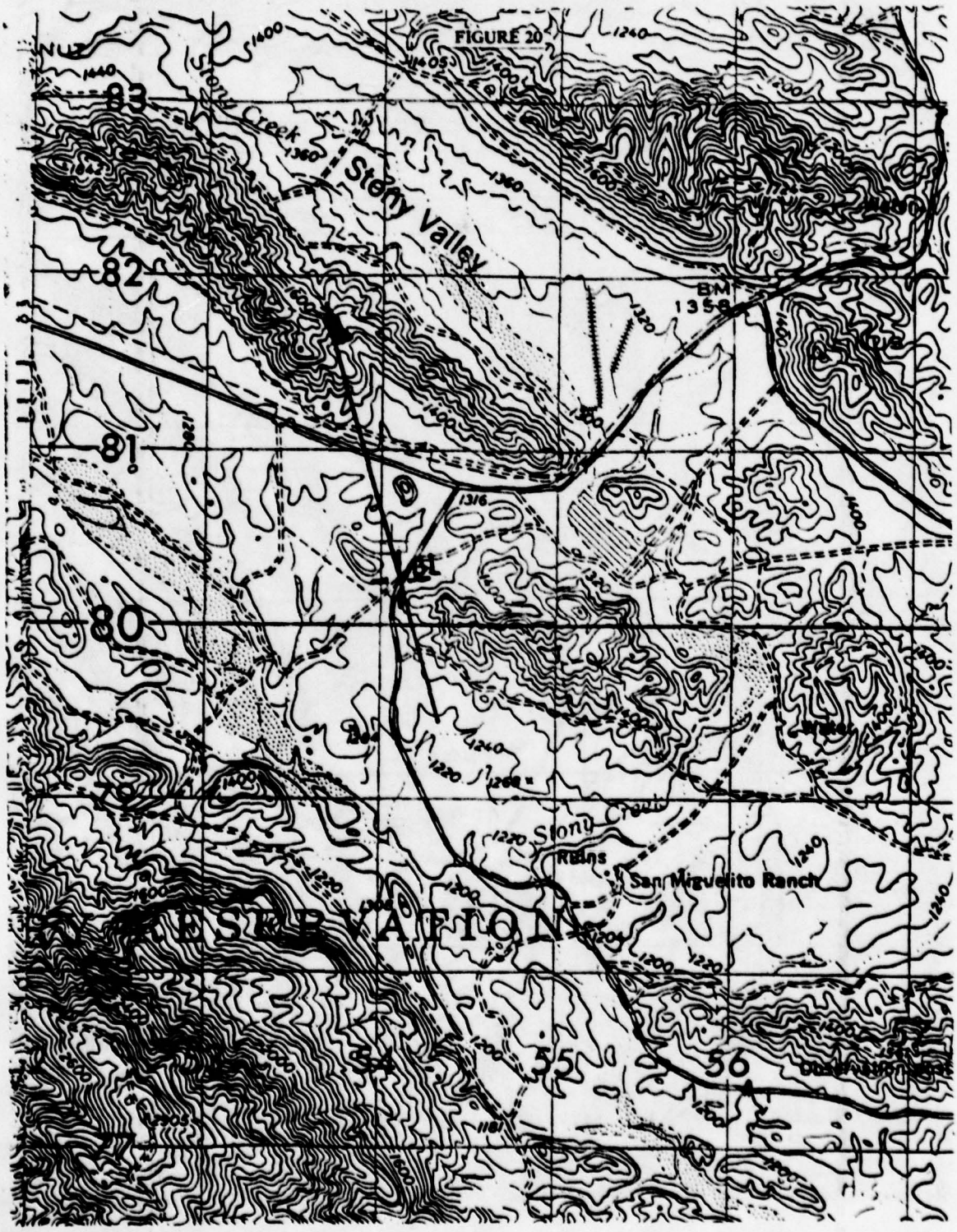


FIGURE 20
Stony Creek
Stony Valley
BM
1358
1316
Stony Creek
Ruins
San Miguelito Ranch
RESERVATION
83
82
81
80
54
55
56

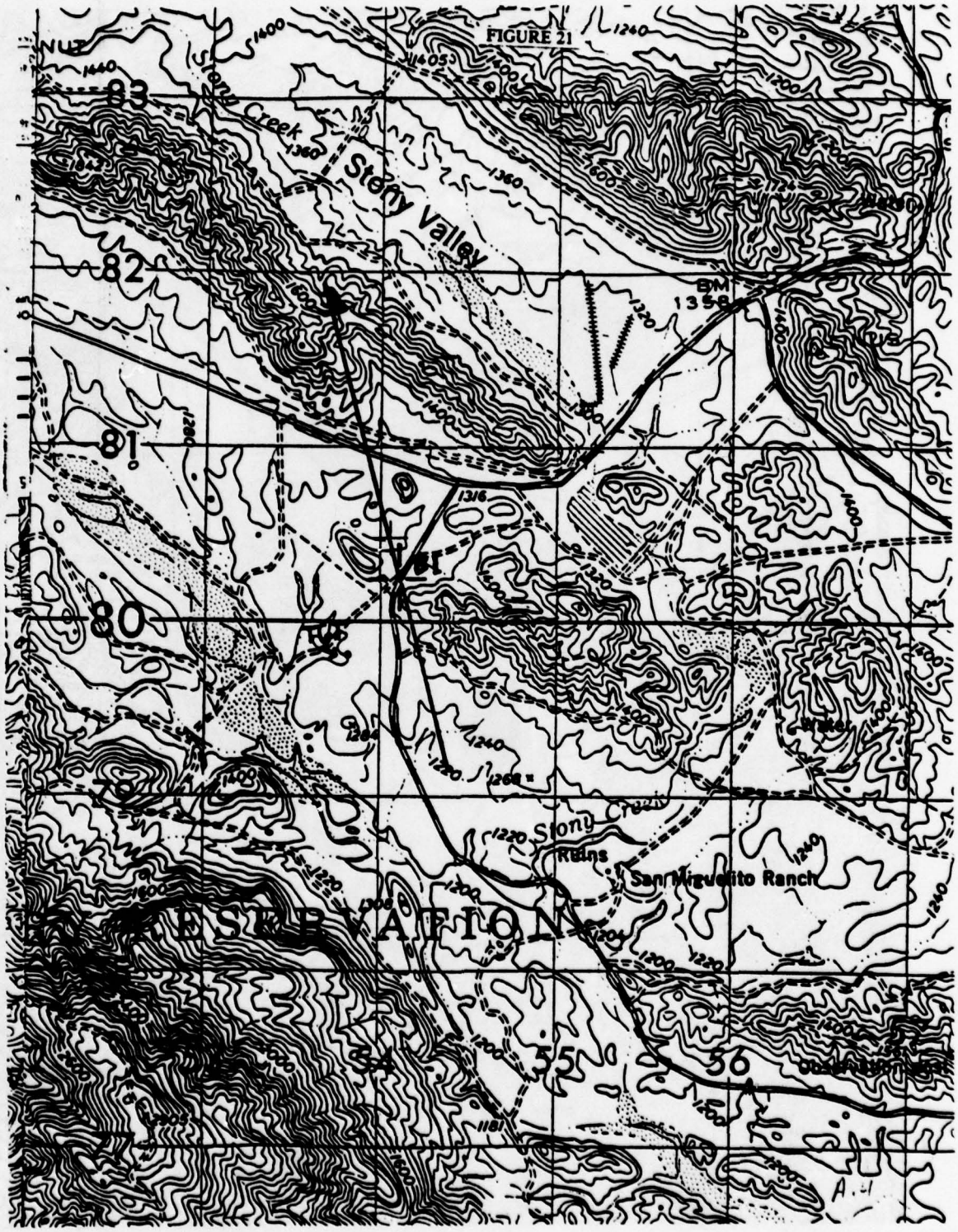


FIGURE 21
Stony Creek
Stony Valley
BM 1358
Stony Creek
Ruins
San Miguelito Ranch
RESERVATION
83
82
81
80
79
78
55
56
A-1

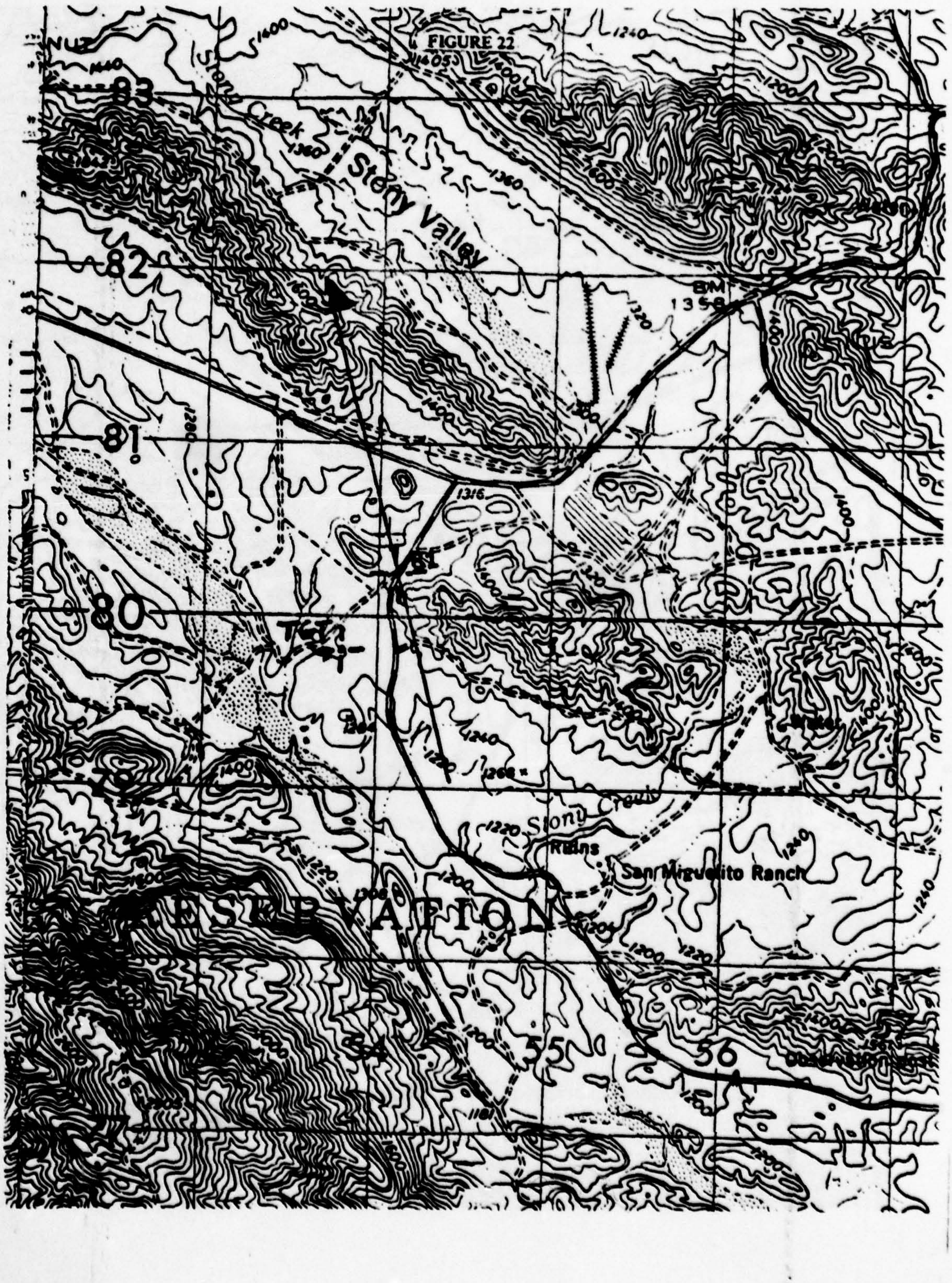


FIGURE 22
Stony Creek
Stony Valley
83
82
81
80
79
BM
1358
1316
Stony Creek
Ruins
San Miguelito Ranch
RESERVATION
54
55
56

FIGURE 23

MISSION SHEET

Fire Marker 37.75

Call Sign: WHITE Frequency: Control 60.55 Date: 8 AUG

From	Target Location	O-T Direction	Ammunition No.	Ammunition Type	Time Received	Time Delivered	Kills
B26	FmB1, L900-400	345 DEG	1	HE	1315	1320	
	R100+200		1	HE	1322	1325	
	-100 FFE		5	HE	1327	1330	TRW 18

Module B: Observers, Indirect Fire Controllers (IDFC) and Fire Markers (FM)

1. General.

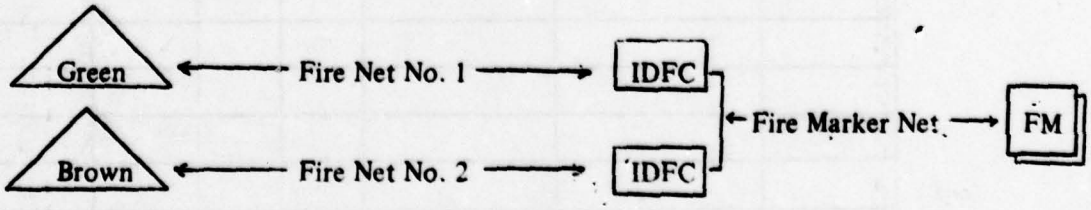
a. This module is recommended for small (platoon or less per side) foot-mobile infantry exercises held in small training areas (less than two kilometers long by one kilometer wide).

b. This module requires two IDFCs, one per side, and at least two fire marker teams. IDFCs receive and process fire requests and direct fire markers. They should be co-located with the Net Control Station. FMs may be on vehicles or on foot. If on foot, each team must still have two soldiers. One operates the compass, the second counts paces. Both carry simulators. Empty sandbags or plastic sacks may be used to carry the simulators.

c. Checkpoints for use by the IDFC and FM must be placed in one or two lines running the length of the training area (Figure B.1). Checkpoints should be 100 meters apart. They may be made from numbered or lettered pieces of paper placed in acetate and nailed to trees or on the ground. If possible, checkpoints should be placed alongside trails. FMs should physically locate all checkpoints before the exercise starts. Checkpoint locations must be marked on IDFC and FM maps.

2. Communications.

a. Three channels are required:



b. If there is a shortage of available frequencies, the platoon tactical nets may be used instead of the fire nets in requesting fire.

c. The two IDFCs are co-located in a central location in the training area. One radio on the fire marker net is placed between them for common use.

3. **Fire Planning.**

a. If FIST memberse are present, they attend the supported unit's tactical briefing, advise commanders on fire support and assist in planning fires. Each side is authorized one pre-planned target.

b. If FIST members are not present, the unit commander plans his indirect fire to support his maneuver/defense plan. He selects the location of his pre-planned target.

c. IDFCs obtain the locations of the pre-planned target, if any, from the unit leaders/FISTs. Fire markers should be initially located in concealed positions near pre-planned targets.

4. **Procedure.**

a. Any soldier may send a fire request to FMCC, limited only by unit SOP. Target locations may be in coordinates or by shift from pre-planned target.

b. IDFC receives mission and records data on either DA Form 4504 (Annex E) or on Fire Record Card (Annex E1). He plots target location on map or grid sheet and computes the azimuth and distance from the nearest checkpoint to the target. He sends the azimuth and distance to the FM. He receives adjustments from the observer and converts these to azimuth and distance from the previous simulator for FM use.

c. FM uses compass and estimation/pacing to move from checkpoint to initial target location and from previous simulator to adjusted location. At end of mission, returns to nearest checkpoint and reports location to IDFC.

d. At end of exercise, IDFC collects Form 4504s/Fire Record Cards and FM Mission Sheets, arranges them in chronological order and delivers them to senior controller for use in the After-Action Review. IDFCs and FMs participate in Controller Debrief and After-Action Review.

5. **Examples.**

a. Grid Coordinate Mission.

OBSERVER (G33)	IDFC (FC)	FM (RED)
FC, THIS IS G33, ADJUST FIRE, OVER.	(On fire net) G33, THIS IS FC, ADJUST FIRE, OUT.	
GRID 333663, MACHINE GUN, REQUEST VT, OVER.	(On fire net) GRID 333663, MACHINE GUN, REQUEST VT, OUT. Records data on 4504, plots location on map (Figure 24). Measures azimuth from P to target as 119 degrees (Figure 25). Measures distance from P to target as 540 meters. (Figure 26) (On fire marker net) RED, THIS IS FC, FIRE MISSION, OVER.	
		FC, THIS IS RED, FIRE MISSION, OUT.
	(On fire marker net) FROM P, DIRECTION 119, DISTANCE 540, AIR BURST, OVER.	
		FROM P, DIRECTION 119, DISTANCE 540, AIR BURST, OUT. Records data on Mission Sheet. Proceeds to Checkpoint P, measures azimuth 119, proceeds in that direction for 540 meters. When about 200 meters from location, RED, SHOT, OVER.
	(On fire marker net) SHOT, OUT. (On fire net) SHOT, OVER.	
SHOT, OUT. Observes target area.		Arrives at location, fires air burst simulator.
DIRECTION 145 DEGREES, RIGHT 100 ADD 200, OVER.		
	(On fire net) DIRECTION 145 DEGREES, RIGHT 100, ADD 200, OUT. Records correction on 4504. Draws line at azimuth 145 from target plot, measures Right 100 and Add 200, plots new location (Figure 27). Measures azimuth and distance from previous point to new plot as Azimuth 170, Distance 230. (Figure 28) (On fire marker net) DIRECTION 170, DISTANCE 230, OVER.	

Grid Coordinate Mission (continued).

OBSERVER (G33)	IDFC (FC)	FM (RED)
		DIRECTION 170, DISTANCE 230, OUT. Records data. Measures azimuth of 170 with compass, proceeds 230 meters. En route, SHOT, OVER.
	(On fire marker net) SHOT, OUT. (On fire net) SHOT, OVER.	
SHOT, OUT. Observes target area.		
DROP 100, FIRE FOR EFFECT, OVER.		Arrives at new location, fires air burst simulator.
	(On fire net) DROP 100, FIRE FOR EFFECT, OUT. Records data. Computes back azimuth of O-T direction of 145 degrees (145 + 180 = 325). (On fire marker net) DIRECTION 325, DISTANCE 100, FIRE FOR EFFECT, OVER.	
		DIRECTION 325, DISTANCE 100, FIRE FOR EFFECT, OUT. Records data. Measures azimuth of 325, proceeds to new location. En route, SHOT, OVER.
	(On fire marker net) SHOT, OUT. (On fire net) SHOT, OVER.	
SHOT, OUT. Observes target area.		
		Marks fire for effect pattern. ROUNDS COMPLETE, OVER.
	(On fire marker net) ROUNDS COMPLETE, OUT. (On Fire net) ROUNDS COMPLETE, OVER.	
ROUNDS COMPLETE, OUT. Observes simulator burst over machine gun. END OF MISSION, MACHINE GUN DESTROYED, OVER.		
	(On fire net) END OF MISSION, MACHINE GUN DESTROYED, OUT. (On fire marker net) END OF MISSION, OVER.	
	Completed 4504 is at Figure 29.	END OF MISSION, OUT. (On control net) MACHINE GUN DESTROYED, HELMET NUMBERS 10 & 47 KILLED BY MORTARS, MACHINE GUN DESTROYED, HELMET NUMBERS 10 & 47 KILLED BY MORTARS. Returns radio to fire marker channel.
		Completed mission sheet is at Figure 30.

Grid Coordinate Mission (continued).

OBSERVER (G33)	IDFC (FC)	FM (RED)
	(On fire marker net) RED, THIS IS FC, CHECK-POINT N, ROGER, OUT.	Proceeds to nearest checkpoint. (On fire marker channel) FC, THIS IS RED, AM AT CHECKPOINT N, OVER.

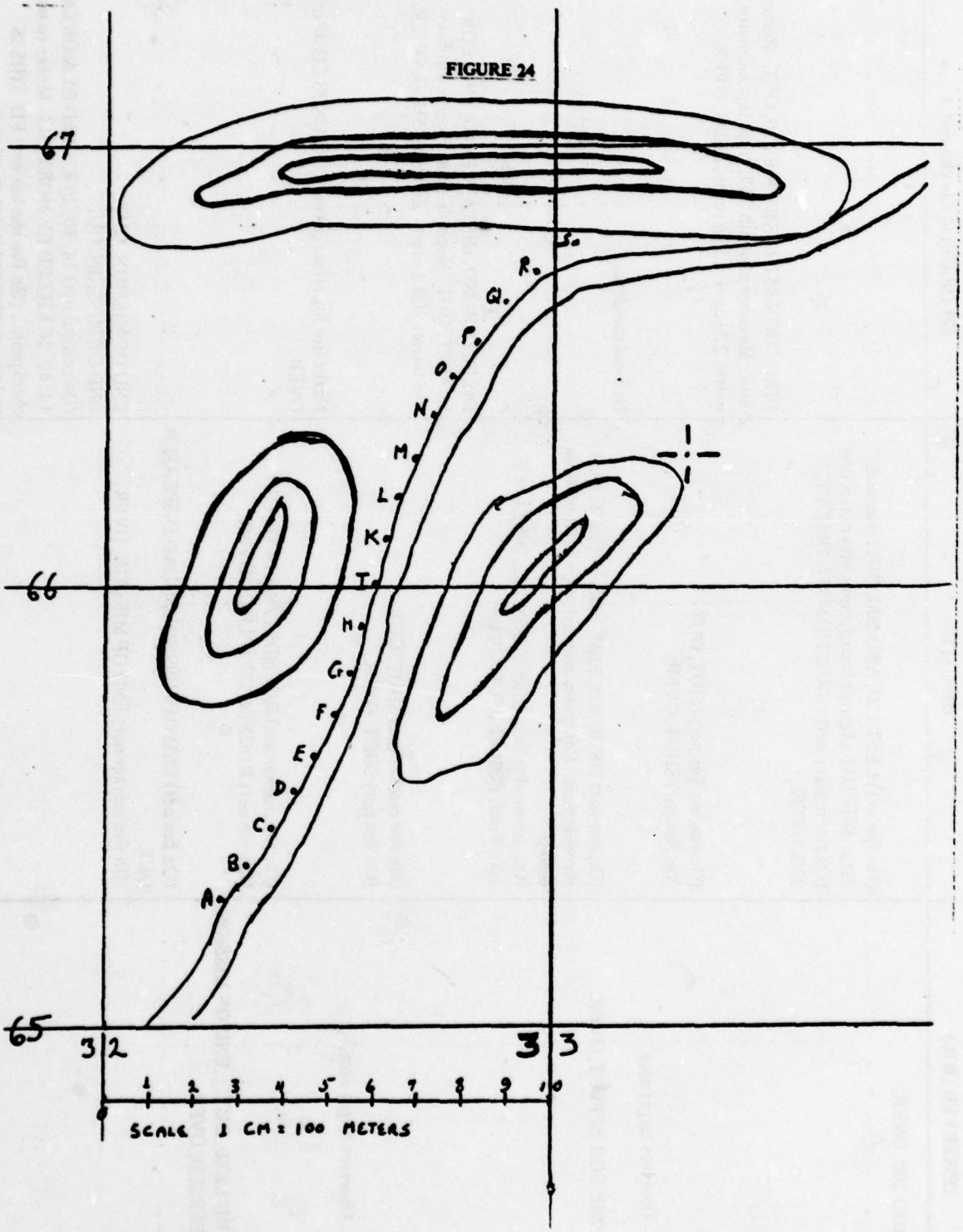
b. Shift from Pre-Planned Target. 4504 for this mission is Fig. 31, mission sheet at Fig. 32, and Pre-planned target B5 is at 32706564 (Fig. 33).

OBSERVER (B76)	IDFC (FD)	FM (BLUE) at Checkpoint A
FD, THIS IS B76, SHIFT B5, OVER.	(On fire net) B76, THIS IS FD, SHIFT B5, OUT. Initiates 4504.	
DIRECTION 400, RIGHT 200, DROP 300, INFANTRY SQUAD, OVER.	(On fire net) DIRECTION 400, RIGHT 200, DROP 300, INFANTRY SQUAD, OUT. Records data on 4504. Refers to mil-degree conversion table (Annex D), changes 400 mils to 22 degrees. Plots azimuth 22 degrees from B5 (Figure 34). Plots shift (Figure 35). Azimuth from A to target as 89 degrees and distance as 520 meters. (On fire marker net) BLUE, THIS IS FD, FIRE MISSION, OVER.	
		FD, THIS IS BLUE, FIRE MISSION, OUT.
	FROM A, DIRECTION 89, DISTANCE 520, OVER.	FROM A, DIRECTION 89, DISTANCE 520, OUT. Records data on Mission Sheet. Measures azimuth 89 degrees with compass, moves 520 meters. When approximately 200 meters from location, BLUE, SHOT, OVER.
	(On fire marker net) SHOT, OUT. (On fire net) SHOT, OVER.	
SHOT, OUT. Observes target area.		Upon arrival at location, detonates simulator.

Shift from Pre-Planned Target (continued).

OBSERVER (B76)	IDFC (FD)	FM (BLUE) at Checkpoint A
LEFT 100, ADD 200, OVER.	(On fire net) LEFT 100, ADD 200, OUT. Records data. With M10 plotting board, computes correction. (On fire marker net) DIRECTION 357, DISTANCE 220, OVER.	
		DIRECTION 357, DISTANCE 220, OUT. Records data. Measures azimuth 357, from last simulator, moves 220 meters. En route, SHOT, OVER.
	(On fire marker net) SHOT, OUT. (On fire net) SHOT, OVER.	
SHOT, OUT. Observes target area.		Delivers simulator.
DROP 100, FIRE FOR EFFECT, OVER.	(On fire net) DROP 100, FIRE FOR EFFECT, OUT. Records data. Computes correction on M10 plotting board. (On fire marker net) DIRECTION 202, DISTANCE 100, FIRE FOR EFFECT, OVER.	
		DIRECTION 202, DISTANCE 100, FIRE FOR EFFECT, OUT. Records data. Shoots azimuth and moves 100 meters. En route, SHOT, OVER.
	(On fire marker net) SHOT, OUT. (On fire net) SHOT, OVER.	
SHOT, OUT. Observes target area.		Marks fire for effect pattern. ROUNDS COMPLETE, OVER.
	(On fire marker net) ROUNDS COMPLETE, OUT. (On fire net) ROUNDS COMPLETE, OVER.	
ROUNDS COMPLETE, OUT. . .END OF MISSION, SQUAD DISPERSED, OVER.		
	(On fire net) END OF MISSION, SQUAD DISPERSED, OUT.	
	(On fire marker net) END OF MISSION, OVER.	END OF MISSION, OUT. END OF MISSION, OUT. (On control net) 14, 40, 26 KILLED BY MORTARS; 14, 40, 26 KILLED BY MORTARS. Moves to nearest checkpoint. (On fire marker net) FD, THIS IS BLUE, AT CHECKPOINT C, OVER.
	(On fire marker net) BLUE, THIS IS FD, CHECK-POINT C, ROGER, OUT.	

FIGURE 24


67
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S
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C
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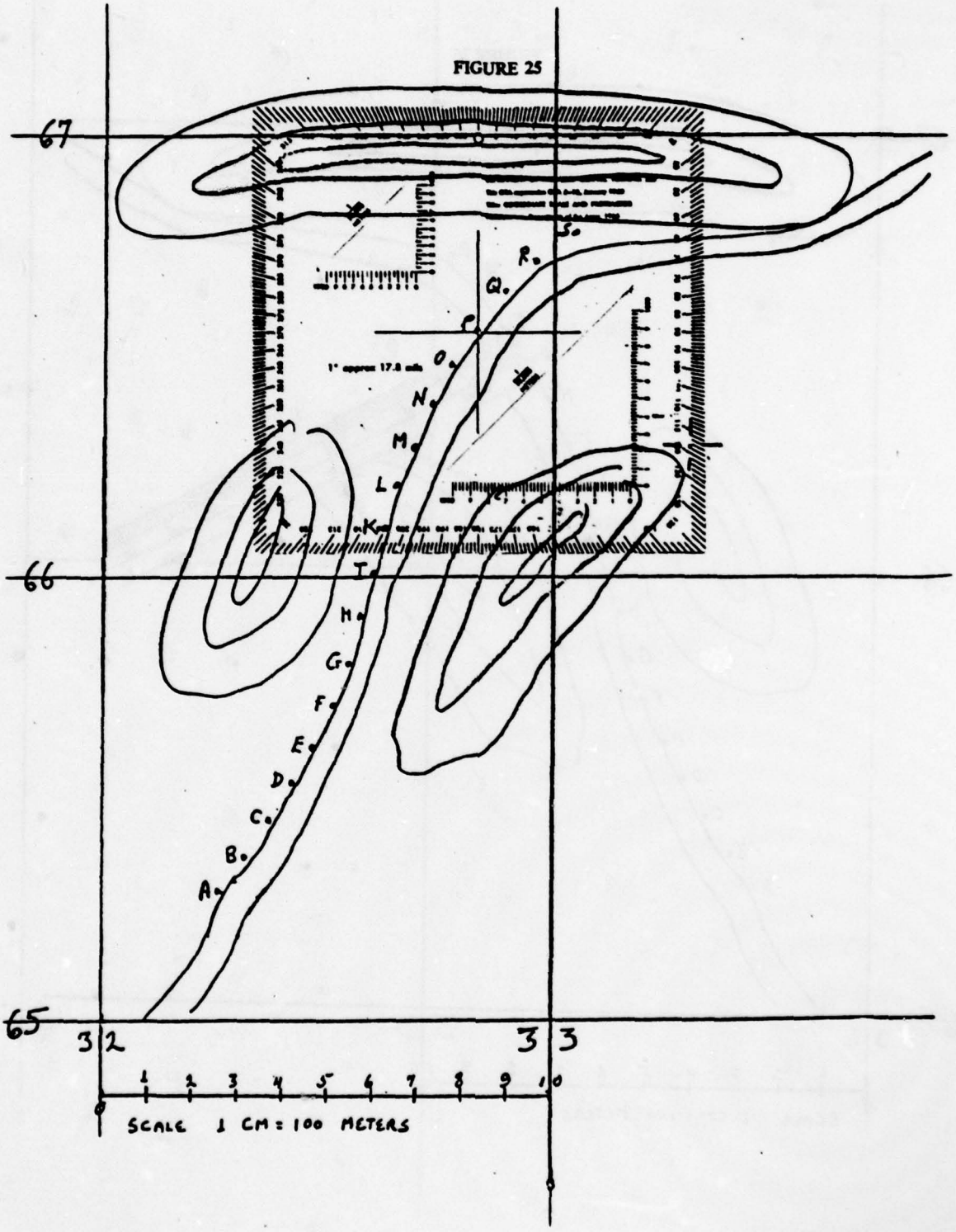
A
3 2
3 3
1 2 3 4 5 6 7 8 9 10
SCALE 1 CM = 100 METERS

FIGURE 25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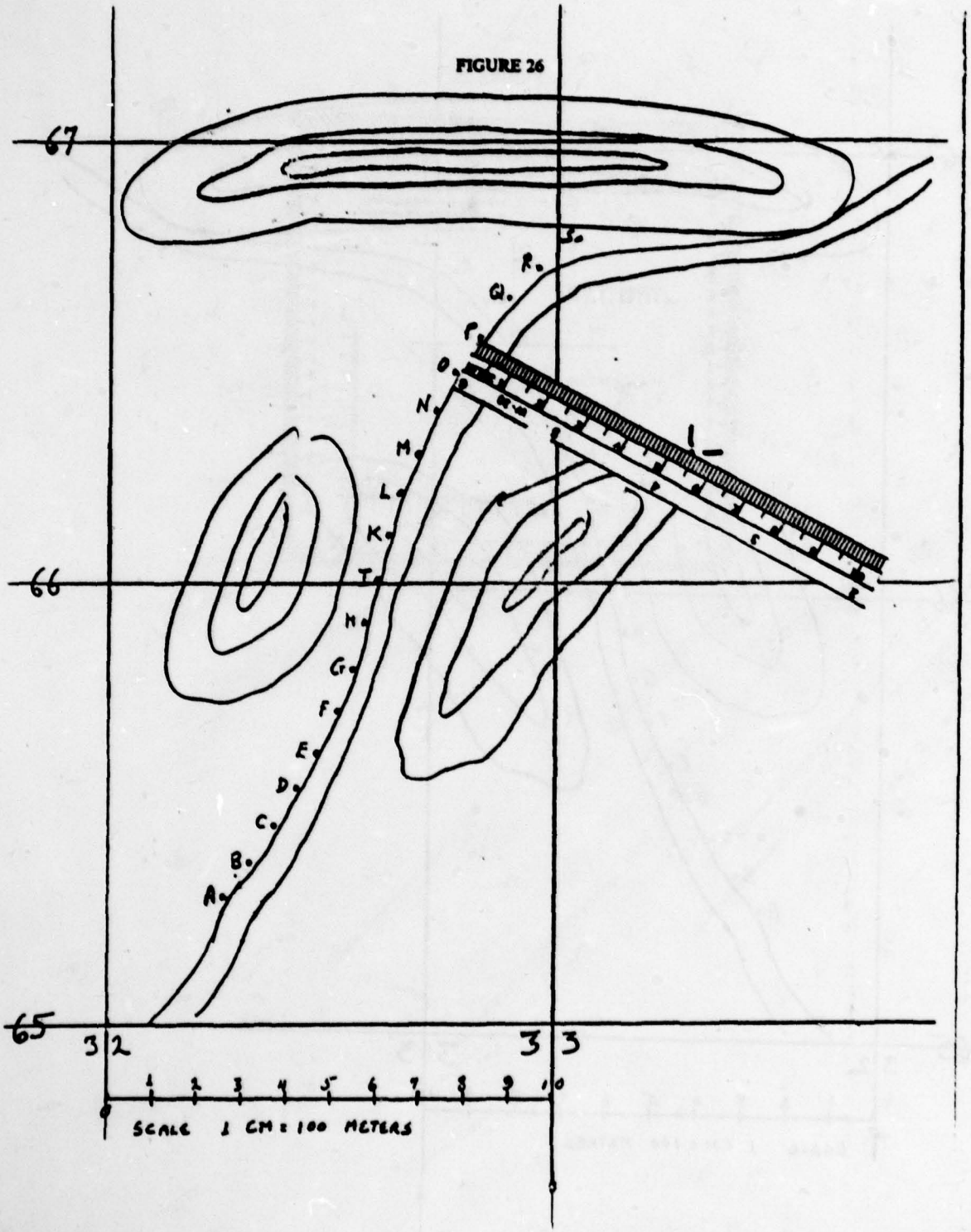
3 2
3 3
1 2 3 4 5 6 7 8 9 10
SCALE 1 CM = 100 METERS

FIGURE 26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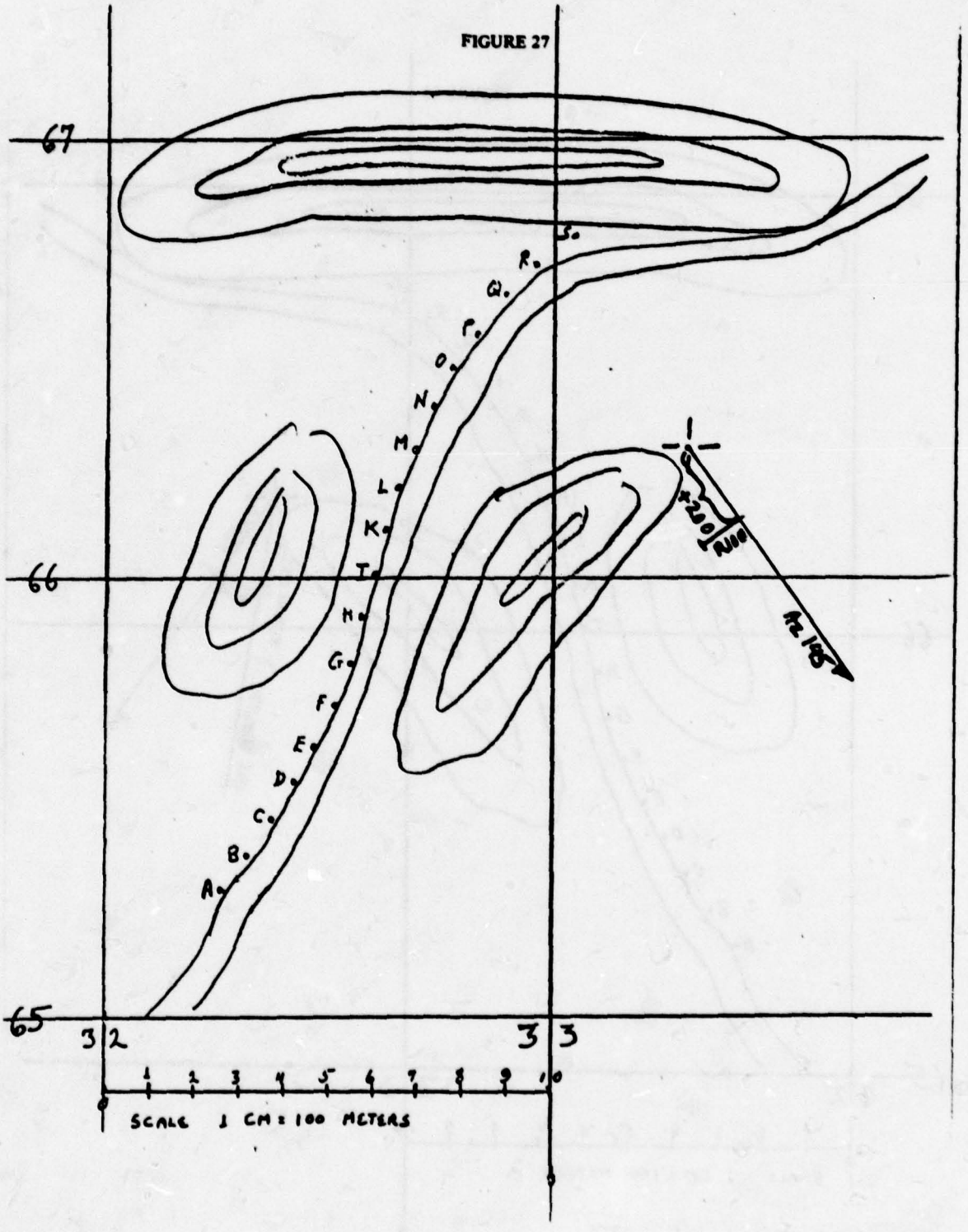
A
32
33
1 2 3 4 5 6 7 8 9 10
0
SCALE 1 CM = 100 METERS

FIGURE 27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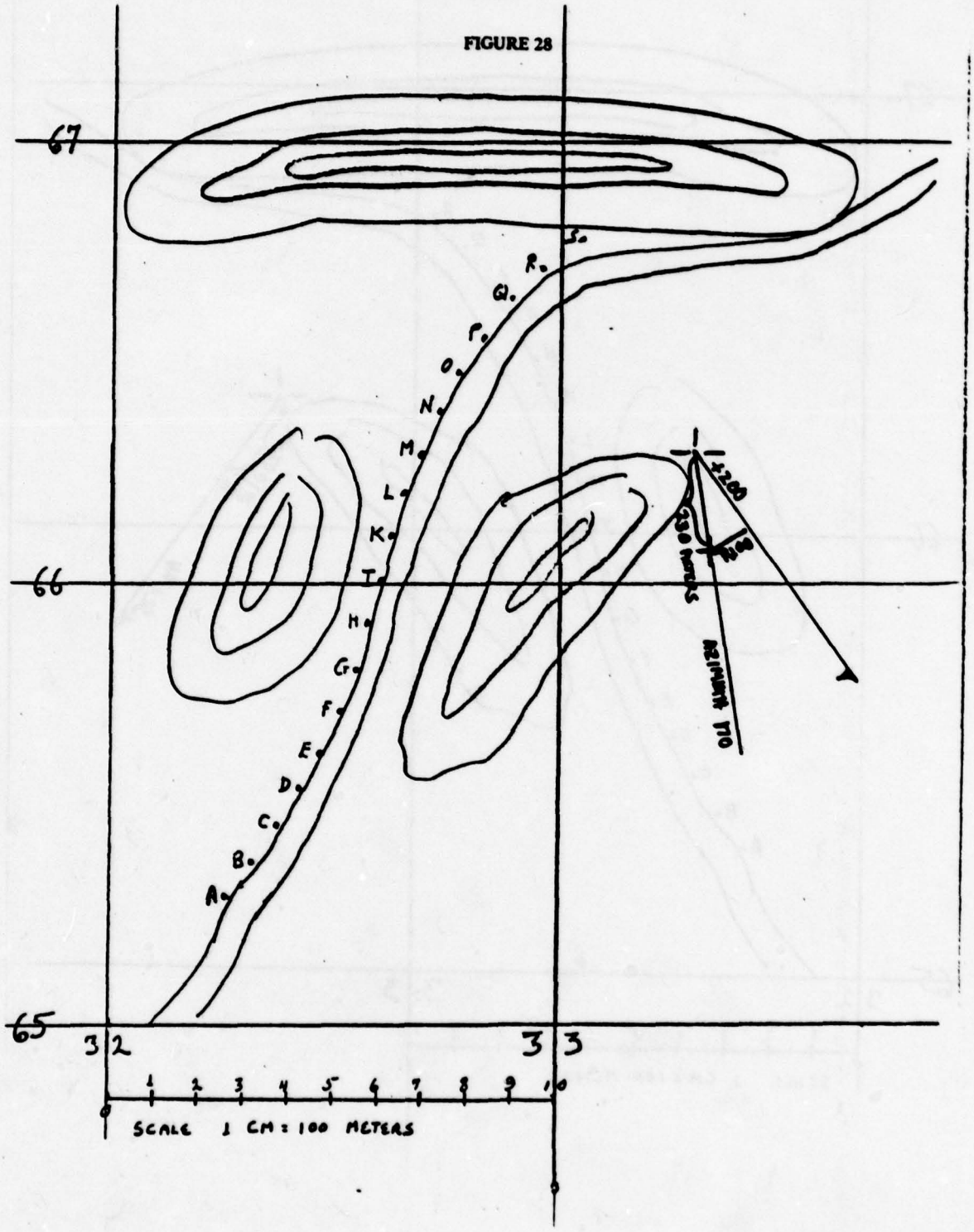
1
N 20° W
N 14°
3 2
3 3
1 2 3 4 5 6 7 8 9 10
0
SCALE 1 CM = 100 METERS

FIGURE 28


67
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D
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B
A
1200 METERS
AZIMUTH 170
0 1 2 3 4 5 6 7 8 9 10
SCALE 1 CM = 100 METERS

FIGURE 29

START: 1405

RECORD OF FIRE

Observer: G33 — CALL FOR FIRE (AF) FFE/IS/S — Tgt: MG / VT

Grid: 333663

Polar: Dir ____ Dis ____ U/D ____ VA ± ____

Shift ____ : Dir ____ L/R ____ +/- ____ U/D ____

ΔFS	
100/R	
/R	
20/R	
∡Si÷10	10 m Si
HOB Corr	
Df Corr	Si
Cht Df	El
Df	QE

FIRE ORDER:

INITIAL FIRE COMMANDS — FM — MF — Rg

Sp Instr: FM P, DIR 119, DIS 540, AIR — Sh — Lot — Chg — Fz — Ti

MTO — ∡T — PE_R — TF — in Eff — Ammo Exp (1) AIR

Tgt	Location	Priority ✓	Firing Unit	SUBSEQUENT FIRE COMMANDS											AMMO	
Dir, MF Sh, Fz	Dev	Rg	HOB Corr	MF, Sh Chg, Fz	FS Corr	Ti	Chart Df	Df Corr ( )	Df Fired	Chart Rg	HOB Corr	Si ( )	El	QE	Exp	Type
145 DEG	R100	+200							170					230	(2)	AIR
		-100 FFE							325					100 FFE	(1)	AIR

Btry: RED — DTG: 1437 — Tgt — Replot Grid — Replot Alt

DA FORM 1 MAY 76 4504 — Replaces DA Form 3022, 1 Jan 74 and DA Form 4007, 1 Jan 73, which are obsolete.

For use of this form, see FM 6-40 and FM 6-40-5; the proponent agency is US Army Training and Doctrine Command.

FIGURE 30

MISSION SHEET

Fire Marker 30.00

Call Sign: RED Frequency: Control 53.00 Date: 10 AUG

From	Target Location	O-T Direction	Ammunition No.	Ammunition Type	Time Received	Time Delivered	Kills
IDFC.	En P, Dir 117, Ds 910		1	AIR	1410	1420	
	Dir 170, Ds 250		1	AIR	1924	1930	
	Dir 325, Ds 100, FFE		5	AIR	1432	1435	MG 10, 47
	EOM						

START 1005

RECORD OF FIRE

Observer B76 CALL FOR FIRE AF/FFE/IS/S Tgt INFSQUAD

Grid:

Polar: Dir Dis U/D VA ±

Shift B5 : Dir 400 @ 200 @ 300 U/D

			△ FS
			100/R
			/R
			20/R
	+Si÷10	10 of Si	HOB Corr

FIRE ORDER | Df Corr | Si

INITIAL FIRE COMMANDS | FM | MF | Rg | Chl Df | El

Sp Instr FM A, Dir 89, Dis 520 | Sh | Lot | Chg | Fz | Ti | Df | QE

MTO | +T | PE R | TF | in Eff | Ammo Exp (1)

Tgt	Location	Priority	Firing Unit	SUBSEQUENT FIRE COMMANDS											AMMO	
Dir, MF Sh, Fz	Dev	Rg	HOB Corr	MF, Sh Chg, Fz	FS Corr	Ti	Chart Df	Df Corr ( )	Df Fired	Chart Rg	HOB Corr	Si ( )	El	QE	Exp	Type
	L100	+200							357					220	(2)	HEQ
		-100 FFE							202					100 FFE	(1)	HEQ

Btry RED | DTG 1026 | Tgt | Repot Grid | Replot Alt

DA FORM 1 MAY 76 4504 Replaces DA Form 3822, 1 Jun 74 and DA Form 4987, 1 Jun 73. unless are obsolete.

For use of this form, see FM 6-40 and FM 6-40-5; the proponent agency is US Army Training and Doctrine Command.

FIGURE 31

FIGURE 32

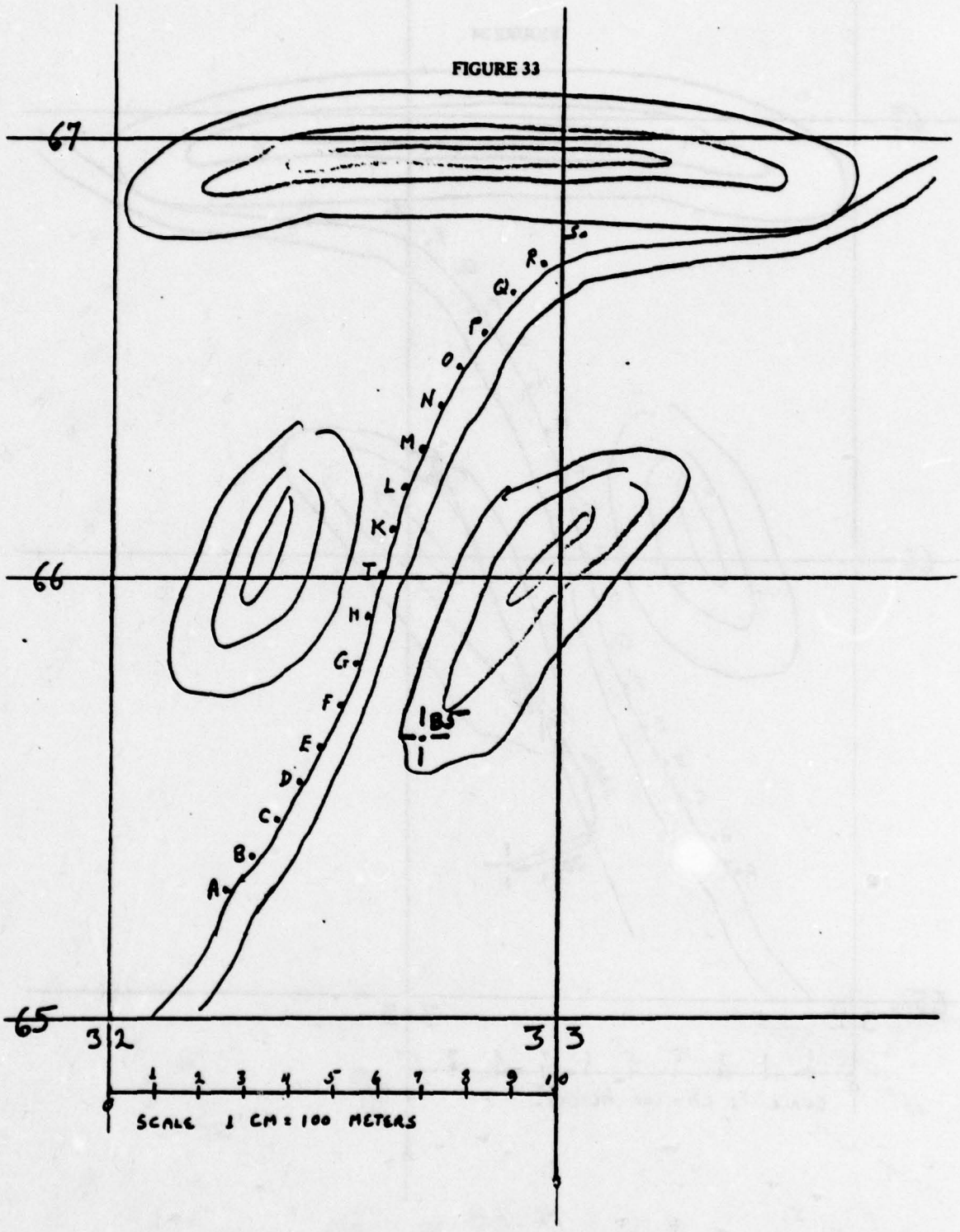
MISSION SHEET

Fire Marker 52.95

Call Sign: RED Frequency: Control 75.95 Date: 10 JUN

From	Target Location	O-T Direction	Ammunition No.	Ammunition Type	Time Received	Time Delivered	Kills
IDF.	FnA, Dir 87, Rg 50		1	GMD	1008	1014	
	Dir 357, Rg 220		1	GMD	1017	1020	
	Dir 202, Rg 180		5	GMD	1022	1024	1 Rg, 2 KIA
		EOM					

FIGURE 33


67
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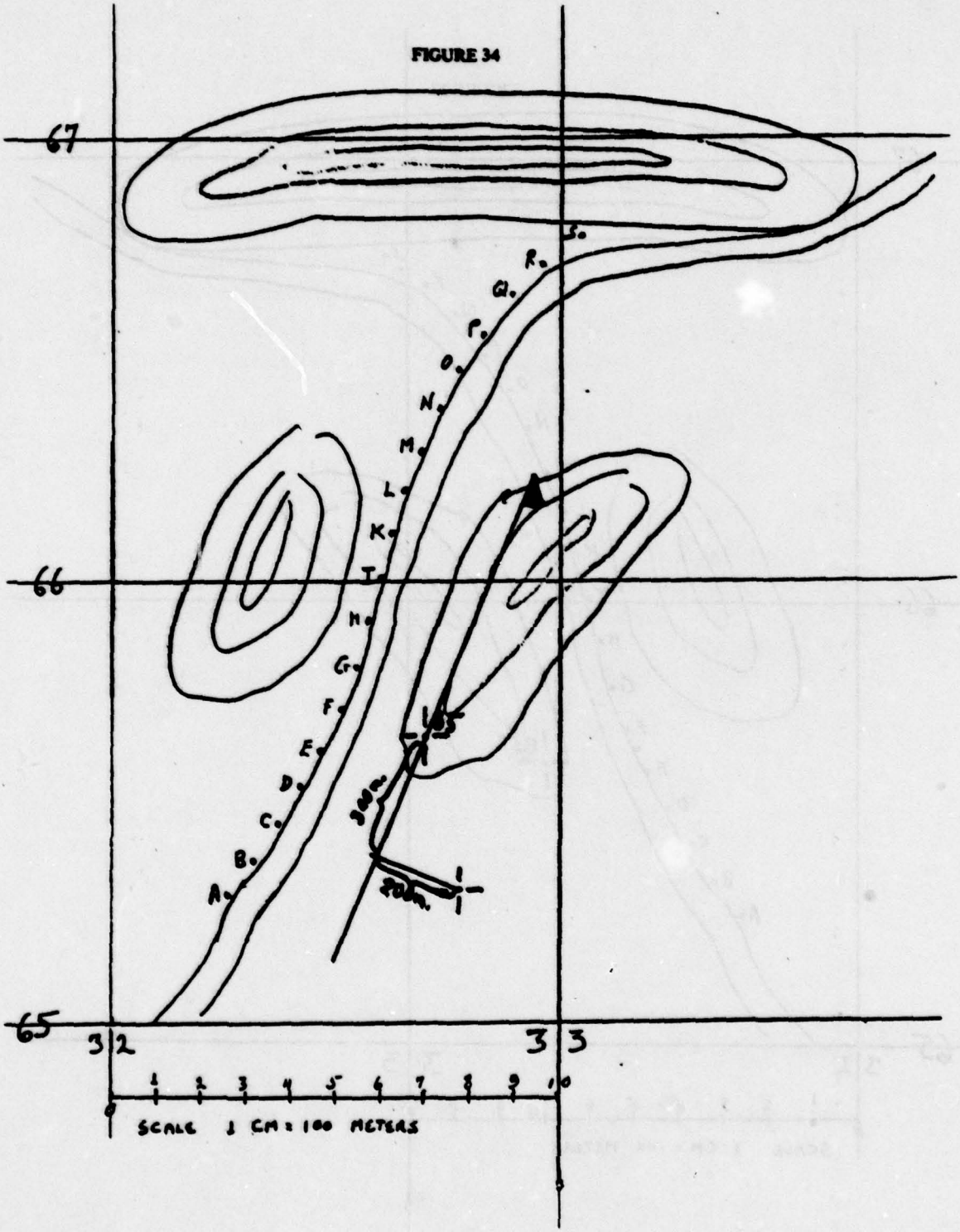
S
1 2 3 4 5 6 7 8 9 10
0
SCALE 1 CM = 100 METERS

FIGURE 34


67
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3 3
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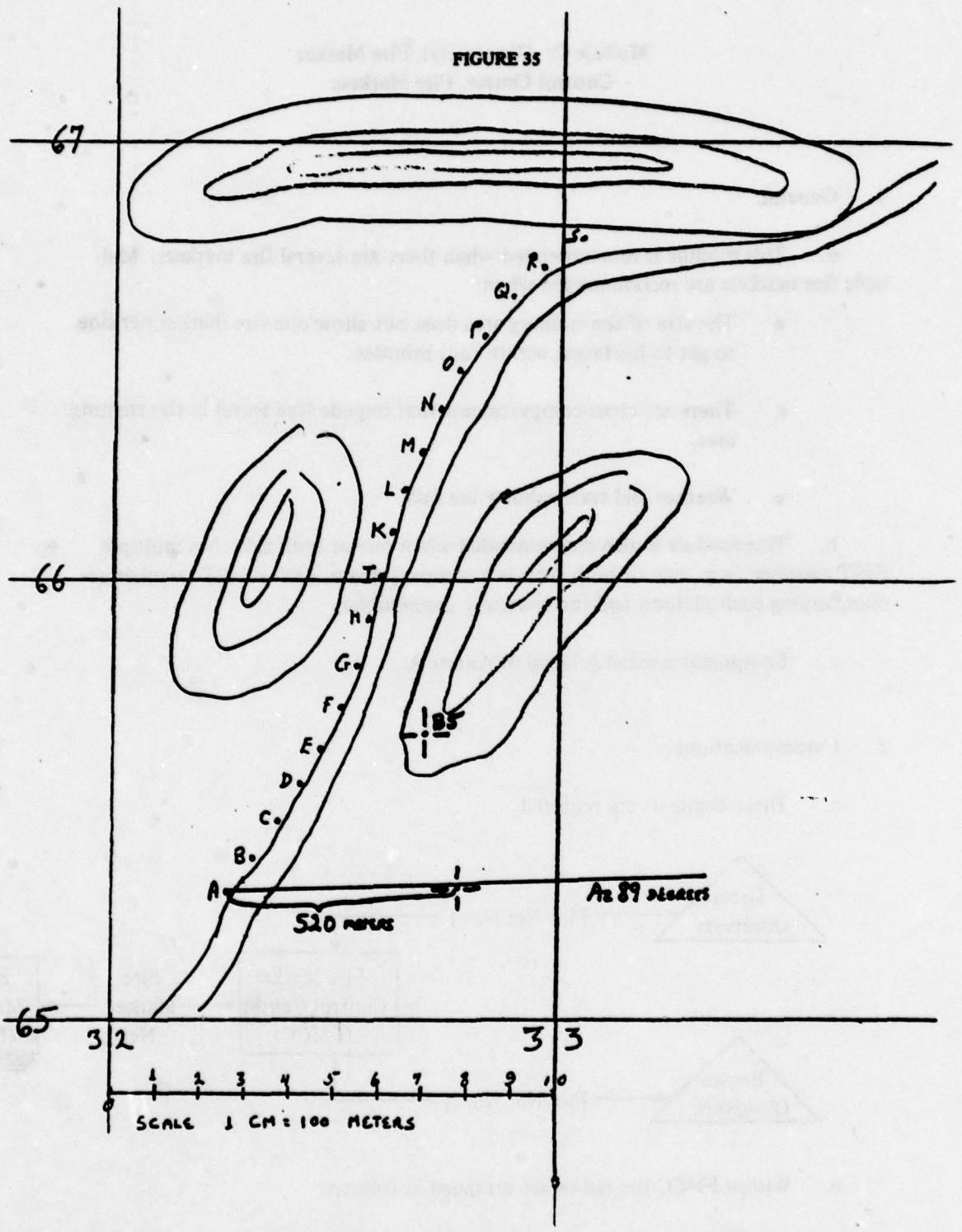
M.
L.
K.
J.
H.
G.
F.
E.
D.
C.
B.
A.
300m.
200m.
1
1
0
1 2 3 4 5 6 7 8 9 10
SCALE 1 CM = 100 METERS

FIGURE 35


67
66
65
S
R
Q
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N
M
L
K
J
H
G
F
E
D
C
B
A
185
520 METERS
AZ 89 DEGREES
3 2
3 3
1 2 3 4 5 6 7 8 9 10
0
SCALE 1 CM = 100 METERS

Module C: Observer(s), Fire Marker Control Center, Fire Markers

1. **General.**

a. This module is recommended when there are several fire markers. Multiple fire markers are recommended when:

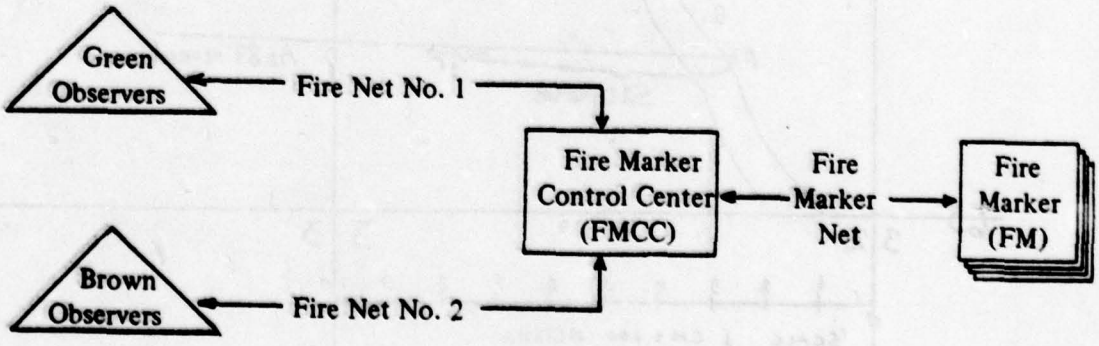
- The size of the training area does not allow one fire marker per side to get to his target within four minutes.
- There are cross-compartments that impede free travel in the training area.
- Weather and trafficability are bad.

b. This module is also recommended when one or both sides has multiple FIST members, e.g., one or both sides is a company team, with a FIST member accompanying each platoon and the company commander.

c. Equipment needed is listed in Annex A.

2. **Communications.**

a. Three channels are required.



b. Within FMCC the radios are arranged as follows:

(1) Fire Net No. 1 on one side, with operator using a head and chest set.

(2) Fire Marker Net in the middle, with operator using a loudspeaker and a hand microphone.

(3) Fire Net No. 2 on the other side, with operator using a head and chest set.

3. Fire Planning.

a. FIST chiefs attend supported units' tactical briefing, advise commanders on fire support and assist in planning fires. Each platoon must designate a maximum of two targets for preplot. Target lists are forwarded to FMCC. FIST chiefs may designate priority target.

b. FMCC plots planned targets. If priority targets are submitted, FMCC positions fire markers near, but not on, those target locations.

4. Preparation.

a. FMCC chief meets with chief controllers before the exercise to receive the boundaries of the problem area. He subdivides the problem area among the fire markers and specifies their initial location. He briefs the fire markers on:

- Initial Location.
- Initial Boundaries. As the problem develops, these boundaries may have to be changed. Such a change will be done in FMCC.
- Types and amounts of simulators to be drawn. Normally, 50 simulators per platoon will be drawn and divided between the fire markers. Breakdown of this total between ground burst, air burst, smoke grenades and smoke pots is a command decision.
- Fire Marker and Control Frequencies.
- Checkpoint System.
- Callsigns. Each fire marker will use callsign corresponding to the color of the map pin used to mark his location in FMCC, e.g. blue, red, yellow, black. Fire marker will attach a flag corresponding to his callsign to his vehicular antenna for identification by controllers and players.
- Time to depart administrative area.
- Safety.

b. Fire markers draw simulators, check radio communications with FMCC, then proceed to initial locations. Upon arrival at initial location, they report to FMCC over fire marker net.

c. Fire marker controller draws initial boundaries on fire marker location chart, plots initial location of fire markers and marks that location with appropriate map pin.

d. If desired by the maneuver unit commander(s), one preplotted target may be marked before the exercise formally starts. This serves to orient the commander, FIST and the fire markers.

e. If Fire Record Card (Annex E1) is being used, computers fill in GRID/ MAGNETIC CORRECTION on cards before exercise starts.

5. FMCC Organization.

a. IDFC (LT, FA or INF, FDO qualified, or E-7, MOS 13E40 or 11C40), supervises FMCC, briefs fire markers, responsible for indirect fire simulation during the exercise. If necessary, acts as fire marker controller (see paragraph 5c below).

b. Green/Brown Computers (E-4/E-5, MOS 13E20 or 11C20), operate fire nets, receive fire requests, convert observer initial fire request and subsequent corrections to instructions to fire markers, operates green/brown firing chart.

c. Fire marker controller (E-5, MOS 13E20 or 11C20), operates fire marker control net, receives fire marker data from computers, selects fire marker to conduct mission, sends data to fire marker, maintains fire marker location chart, maintains ammunition chart.

6. Sample Missions.

a. Grid Coordinates Mission: FMCC Computer in Fire Net, IDFC/Fire Marker Controller in Fire Marker Net.

6. **Sample Missions.**

a. Grid Coordinates Mission: FMCC Computer in Fire Net, IDFC/Fire Marker Controller in Fire Marker Net.

FIST (G62)	FMCC (C25)	FM (BLUE)
C25, THIS IS G62, ADJUST FIRE, OVER		
	Computer: G62, THIS IS C25, ADJUST FIRE, OUT. Initiates 4504.	
GRID 617438, REQUEST SMOKE, OVER		
	Computer: GRID 617438, REQUEST SMOKE, OUT. Completes Call For Fire section of 4504, passes it to IDFC. IDFC checks fire marker chart, selects closest available fire marker. Enters Fire Marker call sign on 4504. IDFC: BLUE, THIS IS C25, FIRE MISSION, OVER	
		C25, THIS IS BLUE, FIRE MISSION OUT. Notes *time received on Mission Sheet.*
	GRID 617438, SMOKE, OVER. Returns 4504 to Computer.	
		GRID 617438, SMOKE, OUT. Enters grid and ammunition on Mission Sheet, plots location, proceeds by fastest route. When about 200 meters away, BLUE, SHOT, OVER
	IDFC: BLUE, SHOT, OUT. Computer: G62, SHOT, OVER	
SHOT, OUT. Observes Target area.		
DIRECTION 6300, RIGHT 200, ADD 400, OVER		
	Computer: DIRECTION 6300, RIGHT 200, ADD 400, OUT. Enters correction on 4504. With M17 plotting board, computes fire marker direction and distance. Enters these on 4504, passes it to IDFC	
	IDFC: DIRECTION 15, DISTANCE 440, OVER	
		DIRECTION 15, DISTANCE 440, OUT. Records data. Shoots azimuth 15, moves 440 meters. When 200 meters out, BLUE, SHOT, OVER

a. Grid Coordinates Mission (Continued)

FIST (G62)	FMCC (C25)	FM (BLUE)
	IDFC: BLUE, SHOT, OUT.	
	Computer: G62, SHOT, OVER.	
SHOT, OUT. Observes target area. LEFT 100, DROP 200, OVER.		Drops smoke grenade at location.
	Computer: LEFT 100, DROP 200, OUT. Records correction, computes FM movement data, enters same on 4504. Passes 4504 to IDFC.	
	IDFC: DIRECTION 192, DISTANCE 230, OVER.	
		DIRECTION 192, DISTANCE 230, OUT. Records data. Measures and moves on azimuth 192 from last grenade for 230 meters. En route, BLUE, SHOT, OVER.
	IDFC: BLUE, SHOT, OUT.	
	Computer: G62, SHOT, OVER.	
SHOT, OUT. Observes target area. ADD 100, FIRE FOR EFFECT, OVER.		Drops smoke grenade.
	Computer: ADD 100, FIRE FOR EFFECT, OUT. Records correction. Computes FM data and enters same on 4504.	
	IDFC: DIRECTION 347, DISTANCE 100, FIRE FOR EFFECT, OVER.	
		DIRECTION 347, DISTANCE 100, FIRE FOR EFFECT, OUT. Measures and proceeds on azimuth 347 for 100 meters. En route, BLUE, SHOT, OVER
	IDFC: SHOT, OUT.	
	Computer: G62, SHOT, OVER.	
SHOT, OUT.		After igniting smoke pot: ROUNDS COMPLETE, OVER.
	IDFC: ROUNDS COMPLETE, OUT.	
	Computer: ROUNDS COMPLETE, OVER.	
ROUNDS COMPLETE, OUT. . .END OF MISSION, SCREEN EFFECTIVE, OVER.		
	Computer: END OF MISSION, SCREEN EFFECTIVE, OUT.	
	IDFC: END OF MISSION, OVER.	
		BLUE: END OF MISSION, OUT.
	Completed 4504 is at Figure 36.	Completed mission sheet is at Figure 37.

START: 1540

RECORD OF FIRE

Observer G 62 CALL FOR FIRE (AF) FFE/IS/S _____ Tgt SMOKE

Grid: 617438

Polar: Dir _____ Dis _____ U/D _____ VA ± _____

Shift _____ : Dir _____ L/R _____ +/- _____ U/D _____

		△ FS
		100/R
		/R
		20/R
÷Si÷10	10 at Si	HOB Corr

FIRE ORDER							Df Corr		Si
INITIAL FIRE COMMANDS	FM	MF				Rg	Chrt Df		El
Sp Instr 617438, SMOKE			Sh	Lot	Chg	Fz	Ti	Df	QE
MTO			÷T		PE R	TF		in Elf	Ammo Exp (1) SMK

Tgt	Location	Priority	Firing Unit	SUBSEQUENT FIRE COMMANDS											AMMO	
Dir, MF Sh, Fz	Dev	Rg	HOB Corr	MF, Sh Chg, Fz	FS Corr	Ti	Chart Df	Df Corr (-7)	Df Fired	Chart Rg	HOB Corr	Si	El	QE	Exp	Type
6300	R200	+900					22	-7	15					4440	(4)	SMK
	L100	-200					199	-7	192					2230	(2)	SMK
		+100	FFE				354	-7	347					1001FE	(1)	POT
							EOM									

Btry BLUE DTG 1604 Tgt Replot Grid Replot Alt

DA FORM 1 MAY 70 4504 Replaces DA Form 3622, 1 Jun 70 and DA Form 4987, 1 Jun 72, which are obsolete.

For use of this form, see FM 6-40 and FM 6-40-5; the proponent agency is US Army Training and Doctrine Command.

FIGURE 36

FIGURE 37

MISSION SHEET

Fire Marker 33.25

Call Sign: BLUE Frequency: Control 51.25 Date: 11 MAR

From	Target Location	O-T Direction	Ammunition No.	Ammunition Type	Time Received	Time Delivered	Kills
	617438		1	SMK	1542	1549	
	Dm 15 Dg 440		1	SMK	1552	1555	
	Dm 192 Dg 230		1	SMK	1557	1559	
	Dm 347 Dg 100	FFE	1	POT	1601	1602	
		EOM					

b. Fire Marker Shift From Checkpoint: Checkpoints 1 through 18 are as shown in Figure 38.

FIST (G63)	FMCC (CF)	FM (BLACK)
	Computer on Fire Net. IDFC/Fire Marker Controller on Fire Marker Net.	
CF, THIS IS G63, ADJUST FIRE, OVER.	Computer: G63, THIS IS CF, ADJUST FIRE, OUT.	
GRID 571799, INFANTRY SQUAD, OVER	GRID 571799, INFANTRY SQUAD, OUT. Checks with IDFC on which checkpoint to use. IDFC checks fire marker chart, notes that FM BLACK is at checkpoint 6, tells computer to use checkpoint 7.	
	IDFC: BLACK, THIS IS CF, FIRE MISSION, OVER.	
		CF, THIS IS BLACK, FIRE MISSION, OUT.
	IDFC: MOVE TO CHECKPOINT 7, FURTHER INSTRUCTIONS LATER, OVER.	
		MOVE TO CHECKPOINT 7; FURTHER INSTRUCTIONS, OUT.
	Computer measures azimuth and distance from checkpoint 7 to target, corrects for G-M angle, enters data on 4504 (Fig. 39). Passes 4504 to IDFC.	
	IDFC: BLACK, DIRECTION 132, DISTANCE 660, OVER.	
		DIRECTION 132, DISTANCE 660, OUT. Records data on Mission Sheet. Measures azimuth 132, moves estimated 660 meters. When about 200 meters away, BLACK, SHOT, OVER.
	IDFC: BLACK, SHOT, OUT.	
	Computer: G63, SHOT, OVER.	
SHOT, OUT. Observes target area.		
		Arrives at location, detonates simulator.
DIRECTION 5600, RIGHT 200, ADD 400, OVER.		
	Computer: DIRECTION 5600, RIGHT 200, ADD 400, OUT. Enters data on 4504. Computes FM correction using M17 Plotting Board. Enters correction on 4504, passes it to IDFC.	
	IDFC: BLACK, DIRECTION 328, DISTANCE 450, OVER.	

b. Fire marker Shift From Checkpoint (Continued)

FIST (G63)	FMCC (CF)	FM (BLACK)
		DIRECTION 328, DISTANCE 450, OUT. Records data, measure azimuth 328, moves estimated 450 meters. When about 200 meters from new location, BLACK, SHOT, OVER.
	IDFC: BLACK, SHOT, OUT. Computer: G63, SHOT, OVER.	
SHOT, OUT. Observes target area.		
DROP 200, OVER.		Upon arrival, detonates simulator
	Computer: DROP 200, OUT. Records correction. Takes back azimuth of O-T direction (5600 (5600 - 3200 = 2400), converts to degrees, subtracts G-M angle, enters FM direction and distance on 4504, passes it to IDFC. IDFC: BLACK, DIRECTION 120, DISTANCE 200, OVER.	
		DIRECTION 120, DISTANCE 200, OUT. Records data. Measures azimuth, BLACK, SHOT, OVER. Proceeds 200 meters.
	IDFC: BLACK, SHOT, OUT. Computer: G63, SHOT, OVER.	
SHOT, OUT. Observes target area.		
FIRE FOR EFFECT, OVER.		Detonates simulator.
	Computer: FIRE FOR EFFECT, OUT. Enters FFE on 4504, passes it to IDFC. IDFC: BLACK, FIRE FOR EFFECT, OVER.	
		FIRE FOR EFFECT, SHOT, OVER. Marks FFE pattern.
	IDFC: BLACK, SHOT, OUT. Computer: G63, SHOT, OVER.	
SHOT, OUT.		
		After last simulator is delivered, ROUNDS COMPLETE, OVER.
	IDFC: BLACK ROUNDS COMPLETE, OUT Computer: ROUNDS COMPLETE, OVER.	
ROUNDS COMPLETE, OUT... END OF MISSION, SQUAD DISPERSED.		

b. Fire Marker Shift From Checkpoint (Continued)

FIST (G63)	FMCC (CF)	FM (BLACK)
	Computer: END OF MISSION, SQUAD DISPERSED, OUT. IFC: BLACK, END OF MISSION, OVER. IDFC: NOTHING IN TARGET AREA; BLACK, GO TO CHECKPOINT 8, OVER. Completed 4504 is at Figure 40.	END OF MISSION, NOTHING IN TARGET AREA, OVER. CHECKPOINT 8, ROGER, OUT. Completed mission sheet is at Figure 41.

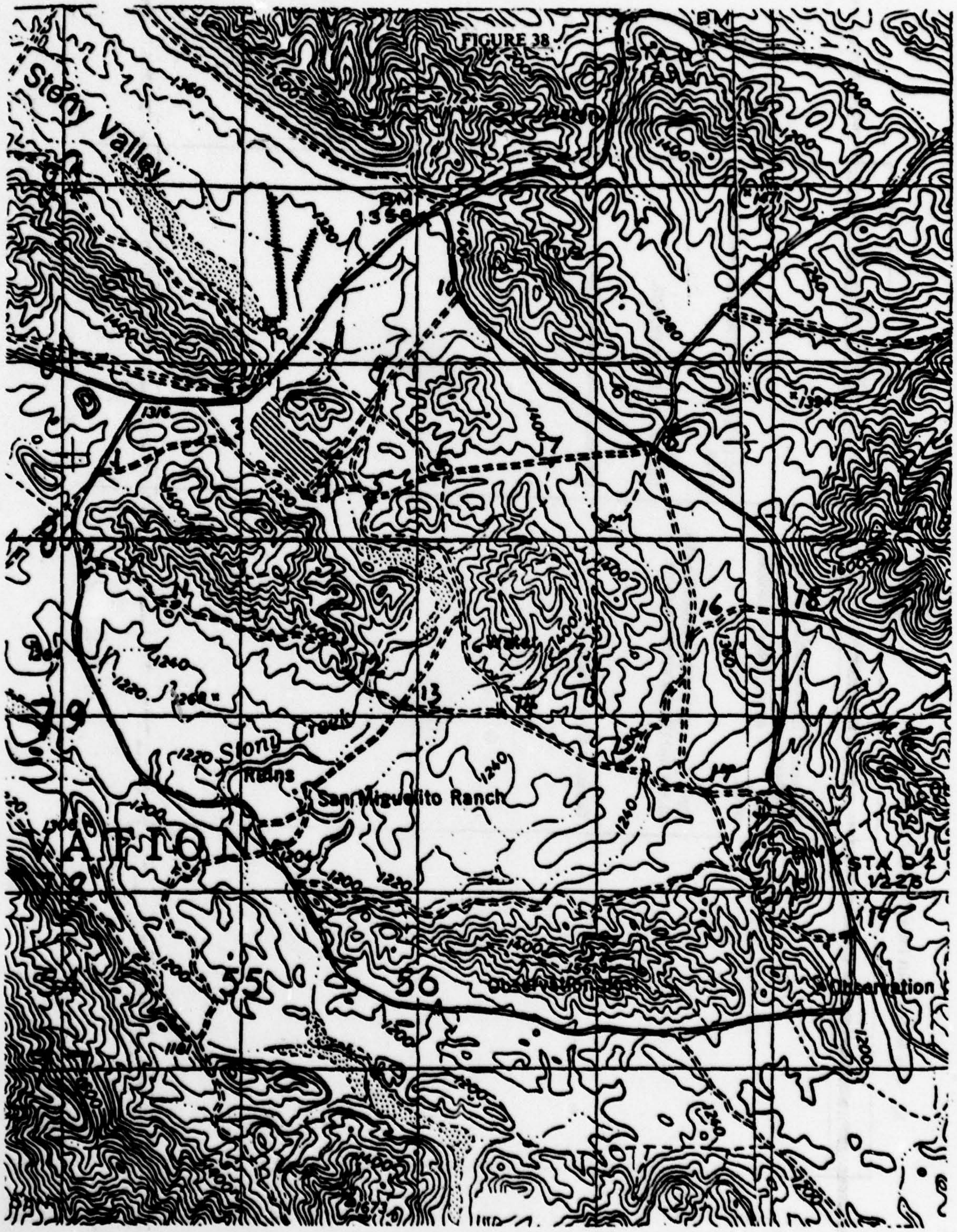


FIGURE 38
Stony Valley
Stony Creek
Ruins
San Miguelito Ranch
Observation
BM
STA

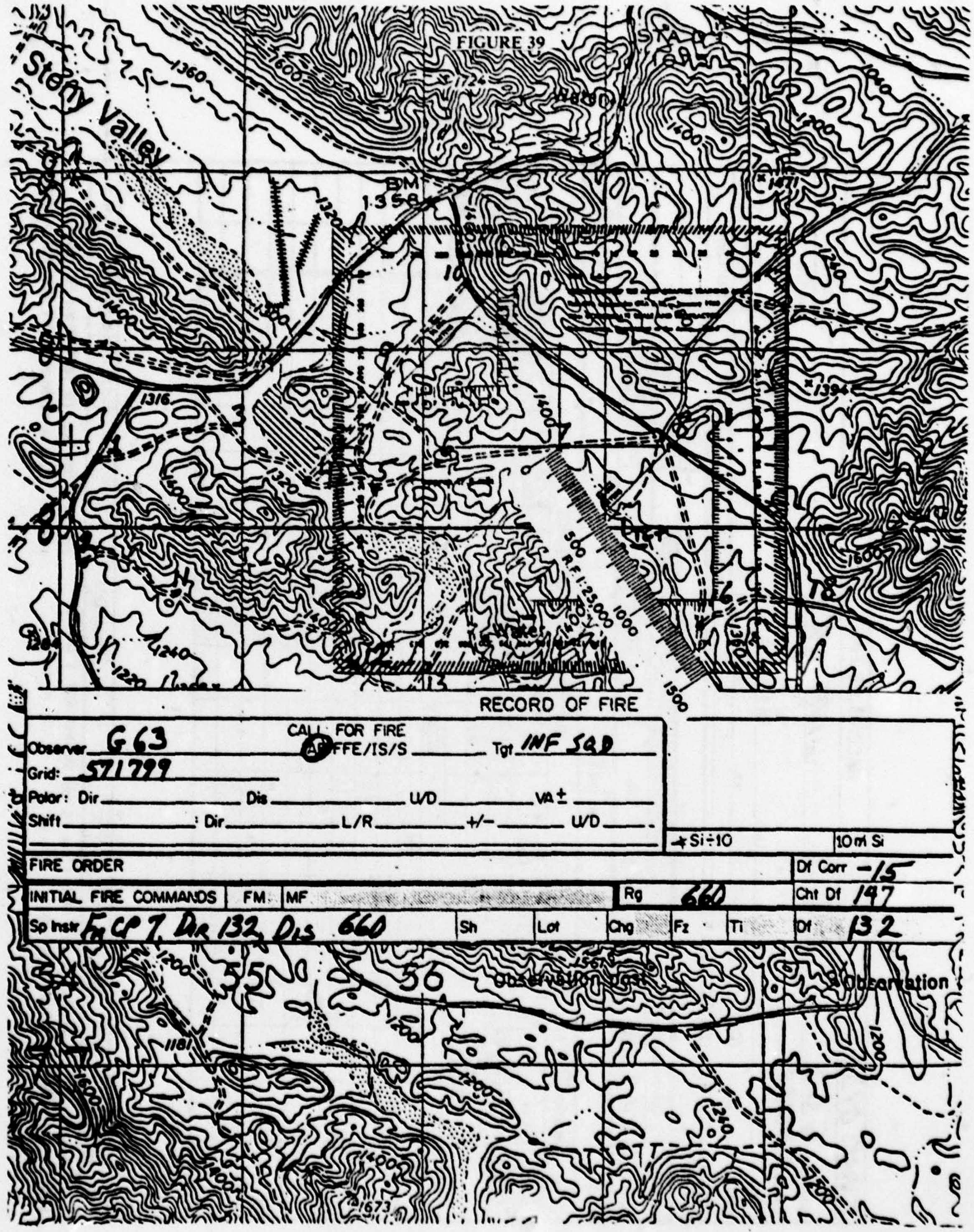


FIGURE 39
Stony Valley
BM 1358
1360
1316
1600
R.F. 1:25,000
500
1000
1500
Water
RECORD OF FIRE
Observer G63
CALL FOR FIRE AF/FFE/IS/S
Tgt INF SQD
Grid: 571799
Polar: Dir Dis U/D VA ±
Shift Dir L/R +/– U/D
±Si÷10
10 m Si
FIRE ORDER
Df Corr –15
INITIAL FIRE COMMANDS FM MF
Rg 660
Cht Df 147
Sp Instr Fm CP 7, Dir 132, Dis 660
Sh Lot Chg Fz Ti
Df 132
55
56
Observation Post
Observation

START: 0933

RECORD OF FIRE

Observer G63 CALL: FOR FIRE (AE) FFE/IS/S _____ Tgt INF SQD

Grid: 571799

Polar: Dir _____ Dis _____ U/D _____ VA ± _____

Shift _____ : Dir _____ L/R _____ +/- _____ U/D _____

		△ FS
		100/R
		/R
		20/R
÷Si÷10	10 in Si	HOB Corr

FIRE ORDER — Df Corr -15 — Si

INITIAL FIRE COMMANDS | FM | MF | Rg 660 | Chk Df 147 | El

Sp Instr FM CP 7, DIR 132, DIS 660 | Sh | Lot | Chg | Fz | TI | Df 132 | QE

MTO | ÷T | PE_R | TF | in El1 | Ammo Exp OTHER

Tgt Dir, MF Sh, Fz	Location Dev	Priority Rg	Firing Unit HOB Corr	SUBSEQUENT FIRE COMMANDS MF, Sh Chg, Fz	FS Corr	Ti	Chart Df	Df Corr (-15)	Df Fired	Chart Rg	HOB Corr	Si ( )	El	QE	AMMO Exp	AMMO Type
56 00	R200	+400	.				343	-15	328					4.50	(2)	HE/C
		-200	"				135	-15	120					2.00	(3)	HE/Q
		FFE												FFE	(8)	HE/Q
							EOM									

Btry BLACK | DTG 1003 | Tgt | Replot Grid | Replot Alt

DA FORM 1 MAY 76 4504 Replaces DA Form 3622, 1 Jan 74 and DA Form 4067, 1 Jan 73, which are obsolete.

For use of this form, see FM 6-40 and FM 6-40-5; the proponent agency is US Army Training and Doctrine Command.

FIGURE 40

FIGURE 41

MISSION SHEET

Call Sign: BLACK Frequency: Control 68.75 Fire Marker 45.75 Date: 2 SEP

From	Target Location	O-T Direction	Ammunition No.	Ammunition Type	Time Received	Time Delivered	Kills
FMCC	FM 097, DIR 132, DIS 660		1	HEQ	0936	0945	
	DIR 328, DIS 450		1	HEQ	0949	0955	
	DIR 120, DIS 240		1	HEQ	0957	0957	
	FFE		5	HEQ	1000	1001	MISS
		EOM					

Module D: Observer(s), Fire Direction Center, Fire Marker Control Center, Fire Markers

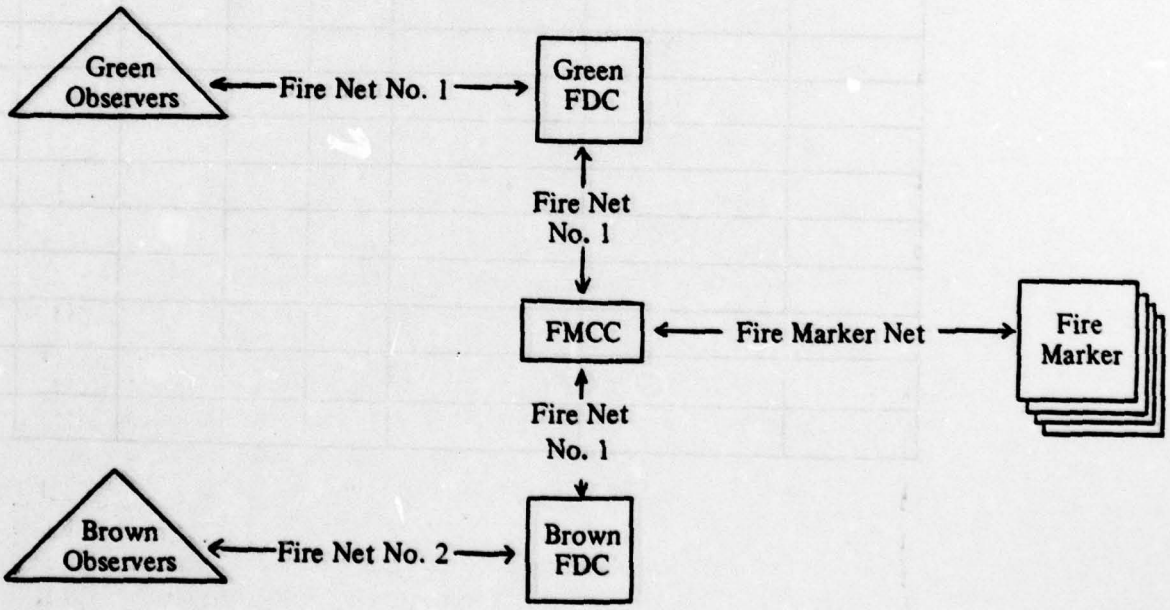
1. **General.**

a. This module is recommended for the same conditions as Module B and when the commander desires to play the Fire Direction Centers (FDC).

b. This module is written for two FDCs. If only one FDC is to be in the exercise, a combination of this module and Module C may be used. The commander should be aware that the side with the FDC may have slower response time because the data has to pass through one operation more than the side without FDC.

c. Equipment needed is listed in Annex A.

2. **Communications.**



Within FMCC, the two fire net radios are on either side, operated by computers wearing headsets. The fire marker net radio is in the middle, operated by the fire marker controller. This radio must have a loudspeaker and hand microphone.

3. Fire Planning.

a. FIST chiefs attend supported unit's tactical briefing, advise commanders on fire support and assist in planning fires. Target lists are forwarded to FDC, FDC passes target lists to FMCC. FIST chiefs may designate priority targets.

b. FMCC plots planned targets. If priority targets are submitted, FMCC positions fire markers near, but not on, those target locations.

4. Preparation.

a. FMCC chief meets with chief controllers before the exercise to define the boundaries of the problem area. He subdivides the problem area among the fire markers and specifies their initial location. He briefs the fire markers on:

- Initial Location.
- Initial Boundaries. As the problem develops, these boundaries may have to be changed. Such a change will be done in FMCC.
- Types and amounts of simulators to be drawn.
- Fire Marker and Control Frequencies.
- Checkpoint System.
- Callsigns. Each fire marker will use callsign corresponding to the color of the map pin used to mark his location in FMCC, e.g. blue, red, yellow, green.
- Time to depart administrative area.
- Safety.

b. Fire markers draw simulators, check radio communications with FMCC, then proceed to initial locations. Upon arrival at initial location, they report to FMCC over fire marker net.

c. Fire marker controller draws initial boundaries on fire marker location chart, plots initial location of fire markers and marks that location with appropriate map pin.

d. FDCs and FMCC computers plot simulated FB positions and azimuths of fire.

5. FMCC Organization.

a. FMCC Chief (O-2, FDO qualified, or E-7, MOS 13E40) supervises FMCC, briefs fire markers, responsible for indirect fire simulation during the exercise.

b. Green/Brown Computers (E-4/E-5, MOS 13E20) operate fire control nets, receive fire requests, convert observer initial fire request and subsequent corrections to instructions to fire markerse, operates green/brown firing chart.

c. Fire marker controller (E-5, MOS 13E20) operates fire marker control net, receives fire marker data from computers, selects fire marker to conduct mission, sends data to fire marker, maintains fire marker location chart, maintains ammunition chart.

6. Indirect Fire Simulation Procedures.

a. Observer sends fire request over fire net, using standard fire request format, cf. TC 6-40-4 or FM 6-40-5, Chapter 5. FDC processes mission using normal procedures.

b. FMCC monitors mission, initially positions fire marker using procedures in Module C.

c. Fire marker records mission on Mission Sheet (Annex B) and moves to target location. When he is within 200 meters of the target location, he transmits his call sign and IN POSITION.

d. FDC sends deflection, charge, site and quadrant elevation to FMCC over the fire net. Computer strips site from quadrant and plots the FDC solution. If this plot is within 100 meters of the location the fire marker was sent to in step b, computer tells fire marker controller, "FDC SOLUTION CHECK." If the plot of the FDC solution is more than 100 meters from the fire marker location, computer measures azimuth and distance from fire marker location to FDC plot, records these on the 4504 and passes it to the fire marker controller.

e. If FDC plot checks out, fire marker controller orders the fire marker to detonate a simulator. Computer sends SHOT over fire net. If observer does not acknowledge SHOT, FDC repeats it.

f. If FDC plot does not check out, fire marker controller sends fire marker direction and distance data from initial location to FDC plotted location, e.g., "BLUE, THIS IS CONTROL, PROCEED TO TARGET LOCATION, DO NOT MARK, FROM THERE GO DIRECTION 100, DISTANCE 500." Fire marker reads back new instructions and executes order. When within 200 meters of new impact point, fire marker sends his call sign and IN POSITION. Fire marker controller orders MARK TARGET. Computer sends SHOT on fire net. Fire marker noves to impact point and marks it.

g. Observer spots detonation and sends correction to FDC. FDC passes correction to FMCC. Computer records correction on the 4504, and uses M10 or M17 plotting board to figure out the azimuth and distance that the fire marker has to move to mark the observer's requested adjustment.

h. Fire marker controller passes correction to fire marker. Steps d through g are repeated until the mission is completed.

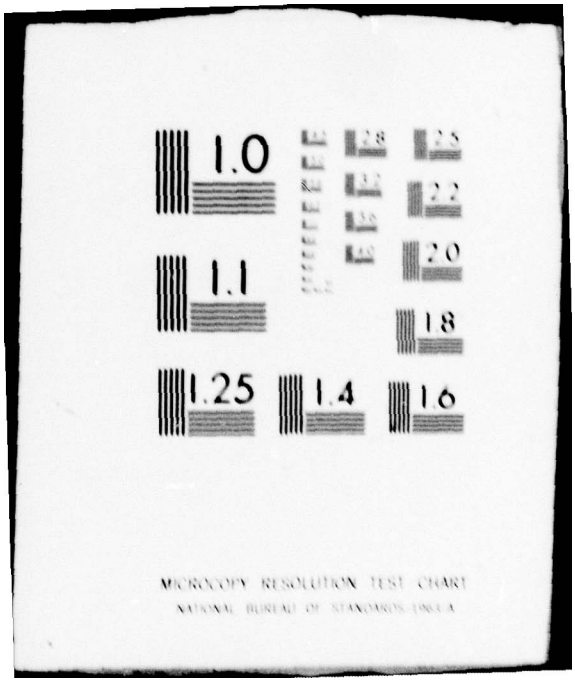
i. At end of mission, fire marker assesses casualties over control net and reports to the fire marker controller effects of fire over fire marker net. He then places his vehicle in the nearest available concealment. Fire marker controller completes the 4504.

j. Throughout the mission, fire marker controller moves the pin representing the fire marker on the fire marker location chart as he orders the fire marker to move. During lulls in the action, he asks the fire markers to send him their location and simulator counts.

AD-A073 725 HUMAN SCIENCES RESEARCH INC MCLEAN VA F/G 5/9
TACTICAL ENGAGEMENT SIMULATION TRAINING TECHNIQUES: INDIRECT FI--ETC(U)
JAN 79 E R SEVILLA DAHC19-76-C-0049
UNCLASSIFIED ARI-RP-79-3 NL

2 OF 2
AD A073725

END
DATE FILMED
10-79
DDC


1.0
1.1
1.25
1.4
1.6
2.2
2.0
1.8
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

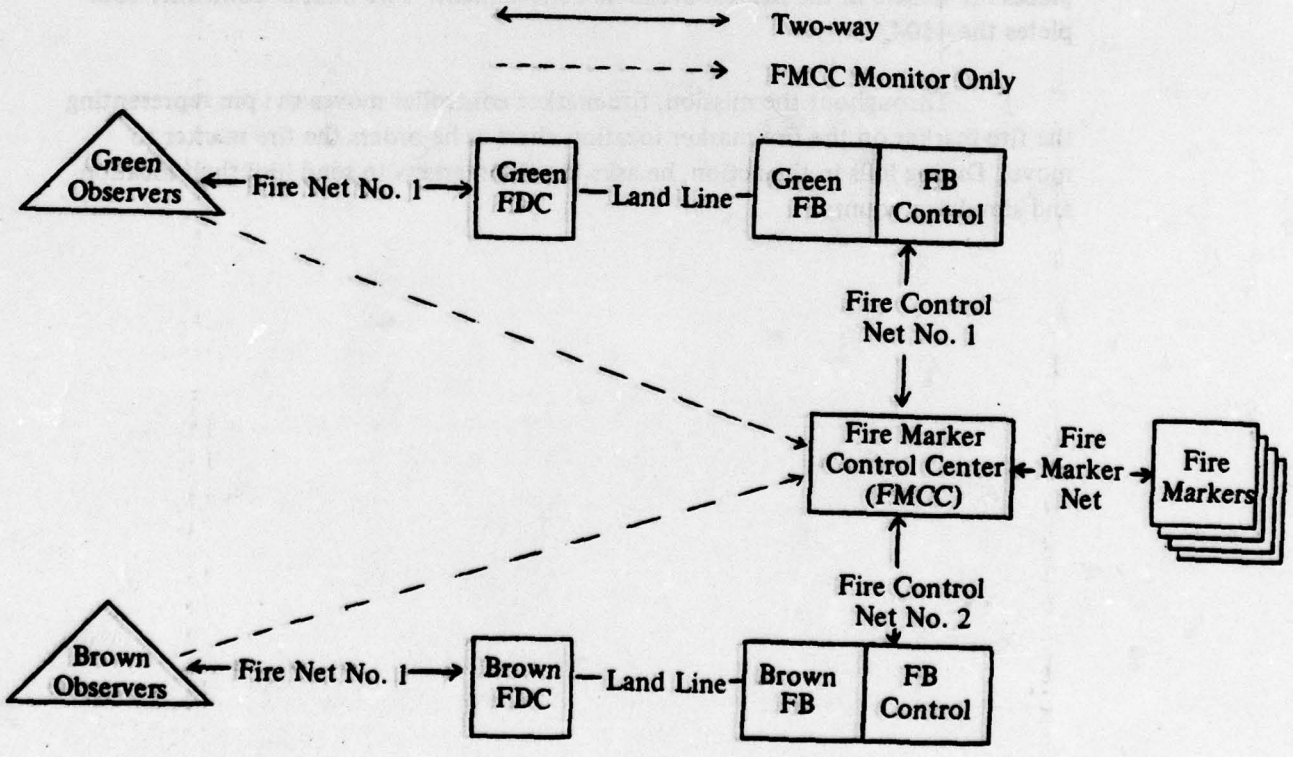
Module E: Observer(s), Fire Direction Center, Fire Batteries, Fire Marker Control Center, Fire Markers

1. General.

a. This module is recommended for use in larger unit exercises (platoon and above) when the commander desires to play the Fire Direction Center (FDC), the firing batteries (FB), and under the same conditions as Module B. This module is written for both sides to have FDCs and FBs. It may be adapted to a situation where only one side has FDC and FB by combining this module with Module C or D. Commanders should be aware that the side using this module may have a slower response time because of the additional steps used to check the FB.

b. In addition to FMCC, this module requires one controller at each FB. See Annex A for equipment.

2. Communications.



Within FMCC, the two computers use head and chest sets. Each head and chest set is connected to two radios so that the computer can continuously monitor the fire net and communicate on the fire control net. The fire marker controller's radio must have a loudspeaker and hand microphone. It stays in the fire marker net.

3. Organization.

a. FDC and FB operate per tactical SOP, except that FB cannot simulate firing until released by FB controller.

b. FB controller rides with FB. He must be qualified in map reading, operation of the aiming circle and fire unit procedures.

4. Fire Planning.

a. FIST chiefs and/or FSOs attend supported unit tactical briefing, advise commanders on fire support and assist in planning fires. Target lists are forwarded to FDC, FDC passes target lists to FMCC. FIST chiefs may designate priority targets.

b. FMCC plots planned targets. If priority targets are submitted, FMCC positions fire markers near, but not on, those target locations.

5. Preparation.

a. FMCC chief meets with chief controllers before the exercise to define the boundaries of the problem area. He subdivides the problem area among the fire markers and specifies their initial location. He briefs the fire markers on:

- Initial Location.
- Initial Boundaries. As the problem develops, these boundaries may have to be changed. Such a change will be done in FMCC.
- Types and amounts of simulators to be drawn.
- Fire Marker and Control Frequencies.
- Checkpoint System.

- Callsigns. Each fire marker will use callsign corresponding to the color of the map pin used to mark his location in FMCC, e.g. blue, red, yellow, green.

- Time to depart administrative area.

- Safety.

b. Fire markers draw simulators, check radio communications with FMCC, then proceed to initial locations. Upon arrival at initial location, they report to FMCC over fire marker net.

c. Fire marker controller draws initial boundaries on fire marker location chart, plots initial location of fire markers and marks that location with appropriate map pin.

d. Upon occupation of position, FB controller sets up his aiming circle. After unit is laid, he measures the azimuth of the direction of fire (FM 6-50, The Field Artillery Cannon Battery, July 1976, paragraph 9-19, pp. 9-26 to 9-27). He reports the FB center coordinates, azimuth of the direction of fire and base deflection to FMCC.

6. Procedures.

a. Observer sends fire request over fire net. FDC processes mission and sends data to FB using normal procedures. FB puts data on the guns, but does not simulate firing until released by the FB controller.

b. FMCC monitors mission, initially positions fire marker using procedures in Module C.

c. Fire marker records mission on Mission Sheet (Annex B) and moves to target location. When he arrives within 200 meters of target location, he halts, and transmits his call sign and IN POSITION.

d. FB controller checks setting on one piece and transmits charge fuze setting announced by ammunition handler, deflection and quadrant to FMCC over Fire Control Net.

e. FDC sends site to FMCC over fire net.

f. Computer strips site from quadrant and plots impact point of data set in FB. If this impact point is within 100 yards of the location initially sent to the fire marker, computer notifies fire marker controller, GREEN (BROWN) GUNS CHECK. If this impact point is more than 100 meters away from the initial location, computer measures the direction and distance from the initial point to the

impact point, enters these in the DF FIRED and QE columns of the 4504 and passes the 4504 to the fire marker controller.

g. If the computer notifies the fire marker controller that the guns check out, the fire marker controller orders the fire marker to hold in place when the fire marker reports IN POSITION. Computer tells the FB controller to release the battery to fire when he hears the fire marker report IN POSITION.

h. If the computer gives correct fire marker data to the fire marker controller, fire marker controller waits until fire marker reports IN POSITION, then orders the fire marker to proceed to the initial location and move in the correct direction and distance, e.g., "BLUE, THIS IS CONTROL, PROCEED TO TARGET LOCATION, DO NOT MARK, FROM THERE GO DIRECTION 120, DISTANCE 500." Fire marker reads back instructions and executes order. When within 200 meters of new impact point, fire marker sends his call sign and IN POSITION. Fire marker controller orders the fire marker to hold in place and computer tells FB controller to release the battery to fire.

i. When FB controller releases the battery, the battery simulates firing by detonating one grenade simulator in front of the muzzle of the firing piece(s) per round. If the grenade simulator detonates, FB notifies FDC "SHOT." FB controller simultaneously tells FMCC "SHOT." If simulator does not go off, FB goes through misfire procedures. FB controller notifies FMCC of misfire. When misfire is cleared and firing simulated, FB and FB controller send "SHOT" to FDC and FMCC respectively.

j. FDC monitors "SHOT" and notifies observer. FMCC computer notifies fire marker controller. Fire marker controller sends "MARK TARGET" to fire marker. Fire marker moves to target location and detonates simulator(s).

k. Observer spots detonation and sends correction to FDC. FMCC monitors observer correction and computes fire marker instructions with M10 or M17 plotting board.

l. Fire marker controller passes correction to fire marker. Steps c through k are repeated until the mission is completed.

m. At the end of the mission, fire marker reports to the fire marker controller effects of fire. He then places his vehicle in the nearest available concealment. Fire marker controller completes the 4504.

n. **Throughout the mission, fire marker controller moves the pin representing the fire marker on the fire marker location chart as he orders the fire marker to move. During lulls in the action, he asks the fire markers to send him their location and simulator counts.**

Module F: Observer, Mortars, Conrollers, Fire Marker(s)

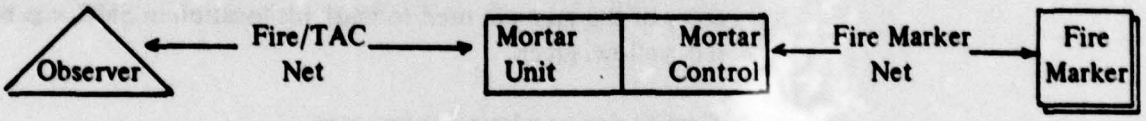
1. General.

a. This module is recommended for use by units with organic mortars, e.g., armored cavalry platoons, mechanized infantry companies when only these mortars are to be used for indirect fire support. If only one side has organic mortars, Module A or B may be used by the side without mortars.

b. This module requires two controllers with each mortar unit. Each side has its own fire marker support. The number of fire markers needed depends on the size of the training area and the nature of the terrain.

2. Communications.

a. Two channels are required per side if the unit wants a discrete fire net. If the unit decides to use its tactical net for indirect fire, only one fire marker channel per side is required.



b. The two unit controllers ride with the mortar unit. The senior mortar controller (SMC) monitors the mortar FDC radio and operates the radio on the fire marker net.

3. Fire Planning.

a. Mortar unit leader attends unit tactical briefing, advises commander on fire support and assists in planning fires and in designating priority targets. He passes target list to SMC.

b. SMC plots planned targets on his map. If priority targets are listed, SMC positions fire markers near, but not on, those target locations.

4. **Preparation.**

a. SMC meets with chief controllers before the exercise to receive the boundaries of the problem area. He subdivides the problem area among the fire markers and specifies their initial location. He briefs the fire markers on:

- Initial Location.
- Initial Boundaries. As the problem develops, these boundaries may have to be changed. Such a change will be done by SMC.
- Types and amounts of simulators to be drawn. Normally, 50 simulators per platoon will be drawn and divided between the fire markers. Breakdown of this total between ground burst, air burst, smoke grenades and smoke pots is a command decision.
- Fire Marker and Control Frequencies.
- Checkpoint System.
- Callsigns. Each fire marker will use callsign corresponding to the color of the map pin used to mark his location in SMC, e.g. blue, red, yellow, green.
- Time to depart administrative area.
- Safety.

b. Fire markers draw simulators, check radio communications with SMC, then proceed to initial locations. Upon arrival at initial location, they report to SMC over fire marker net.

c. SMC draws initial boundaries on fire marker location chart, plots initial location of fire markers and marks that location with appropriate map pin.

d. Controllers ride with the mortars. SMC positions himself where he can observe FDC. Assistant controller (AC) observes the guns.

e. When unit arrives at firing position, SMC map-spots location and pins center of modified target grid (Annex F) over that location on his map. He rotates target grid so that arrow is parallel to a north-south grid line and arrowhead is pointing north. He places a tick mark opposite the arrowhead and labels it N. Assistant controller observes laying of mortars and gives azimuth of direction of fire to senior controller. SMC rotates target grid until that azimuth is opposite N tick mark. He draws a line opposite the arrowhead and labels it with the mounting azimuth. He then rotates the target grid until the base deflection (normally 2,800) is opposite the mounting azimuth line. He then places another pin through the target grid or tapes it to the map to prevent any further rotation of the grid.

5. **Procedure.**

PROCEDURE:	EXAMPLE: (107 mm mortar organic to cavalry platoon)
a. Fire is requested using standard request for fire. (References: TC 6-40-4, Fire for Effect, Modern Battlefield Cannon Gunnery, 1 Jul 76.) FDC uses normal procedures to process the mission with AT MY COMMAND as method of fire. SMC monitors fire request and plots target on his map.	FIST: G46, THIS IS G21, ADJUST FIRE, OVER. FDC: G21, THIS IS G46, ADJUST FIRE, OUT. FIST: FROM A4, DIRECTION 1800, RIGHT 100, ADD 200, ANTI-TANK MISSILE POSITION, OVER. FDC: FROM A4, DIRECTION 1800, RIGHT 100, ADD 200, ANTI-TANK MISSILE POSITION, OUT. SMC plots target location on his map using protractor and coordinate square.
b. SMC immediately dispatches the nearest unoccupied fire marker to the target location. Unless otherwise notified, fire marker (FM) uses one ground burst simulator during the adjustment. FM Notes required data on mission sheet (Annex B) and proceeds to target location.	SMC: BLUE, THIS IS CONTROL, FIRE MISSION, OVER. FM: CONTROL, THIS IS BLUE, SEND YOUR MISSION, OVER. SMC: FROM CHECKPOINT JACK, DIRECTION 45 DEGREES, DISTANCE 600 METERS, OVER. FM: FROM CHECKPOINT JACK, DIRECTION 45 DEGREES, DISTANCE 600 METERS, OUT. Directs driver to target location and prepares one ground simulator.
c. SMC monitors fire commands for deflection, charge and elevation.	FDC: Deflection 2920, Charge 25, Elevation 900.

PROCEDURE:	EXAMPLE: (107 mm mortar organic to cavalry platoon)
• 81 mm mortar–SMC converts charge and elevation to range by referring to Firing Tables. He lays the range scale (Annex G) on the modified target grid (Annex F) with 0 at the unit position and the edge at the announced deflection. He places a pin at the range corresponding to the charge and elevation.	SMC: Refers to FT 4.2-H-2, page 38, reads range as 4310 and drift as 47.9. Rounds drift to 48, subtracts 48 from 2920, gets 2872. Places range scale along 2872 mils on the target grid and drops pin at 4310 meters. Compares this location with requested target location and notes it is about 200 meters off to the south. (FDC forgot to compute drift.) Calls FM on fire marker net: BLUE, THIS IS CONTROL, FROM LAST TARGET LOCATION, SOUTH 200 METERS, OVER.
• 107 mm mortar–SMC converts charge and elevation to range by referring to Firing Tables or Graphical Firing Scale. He also notes drift corresponding to range. He strips the drift correction by subtracting it from the announced deflection. He places range scale (Annex G) with 0 at the unit position and edge along the corrected deflection. He places a pin at the range corresponding to the charge and elevation.	FM: CONTROL, THIS IS BLUE, FROM LAST TARGET LOCATION, SOUTH 200 METERS, OUT.
In either case, SMC then compares pin position with plot of requested target location. If the two are less than 100 meters apart, SMC takes no action at this point. If the two are more than 100 meters apart, SMC redirects the fire marker to the location corresponding to the fire command given by FDC. SMC records.	
d. AC checks gunner, assistant gunner and ammunition handler. He listens for correct read-back of charge and checks sight for correct deflection and elevation. If charge deflection and elevation are correct, he reports "CHECK" to SMC.	AC checks mortar crew, notes 10 mil error in deflection reports: DEFLECTION IS 2910.

PROCEDURE:	EXAMPLE: (107 mm mortar organic to cavalry platoon)
d. If there are errors, he reports the nature and amount of error to SMC. Mortar crew is not allowed to correct error after it has declared mortar ready to fire.	
e. SMC plots effects of any crew errors. If effect is less than 100 meters, he disregards it. If effect is more than 100 meters, he moves the fire marker to the proper direction and distance.	SMC computes 10 mils at 4310 meters as an error of 43 meters. He does not correct the fire marker, but does note the error.
f. When fire marker arrives within 200 meters of desired location, he reports "IN POSITION" to SMC and prepares simulator(s). SMC then releases unit to fire.	FM: CONTROL, THIS IS BLUE, IN POSITION, OVER. SMC: BLUE, THIS IS CONTROL, ROGER, OUT. (TO FDC) YOU ARE CLEARED. (NOTE: SMC does *not* use the word "fire" to avoid confusion.) FM continues toward target.
g. FDC commands "FIRE." Assistant gunner throws grenade simulator in direction of fire. If grenade simulator detonates, SMC orders fire marker to mark target. If grenade simulator does not detonate, gun crew initiates misfire drill. When gunner attempts to refire or kicks the tube, assistant gunner throws another grenade simulator. If this detonates, SMC orders fire marker to mark target. If it does not, gun crew must complete misfire procedures and SMC notifies fire marker to cancel the mission.	FDC: HANG IT, FIRE. Assistant gunner throws grenade simulator in direction of fire. Simulator detonates. SMC: BLUE, MARK TARGET, OVER. FM: BLUE, MARKING TARGET, OUT. Proceeds to target location and throws simulator. FDC: G21, SHOT, OVER. FIST: SHOT, OUT.
h. FIST adjusts fire onto the target as necessary. SMC plots adjustments as soon as they are received and directs FM to move accordingly. SMC and AC AC then repeats steps c, d, and e to check mortar crew. The procedure continues until the mission is completed.	FIST: RIGHT 200, ADD 200, OVER. FDC: RIGHT 200, ADD 200, OUT. SMC draws a line through the pin marking the impact of previous line along the O-T azimuth (1800 mils). He measures the adjustment and directs the fire marker: SMC: BLUE, THIS IS CONTROL, DIRECTION 146 DEGREES, DISTANCE 280 METERS, OVER.

PROCEDURE:	EXAMPLE: (107 mm mortar organic to cavalry platoon)
	FM: CONTROL, THIS IS BLUE, DIRECTION 146 DEGREES, DISTANCE 280 METERS, OVER.
	Proceeds toward new location.
	FDC: DEFLECTION___, CHARGE___, ELEVATION 900.
	SMC plots deflection and range corresponding to charge and elevation, finds plot is within 100 meters of requested location.
	AC: CHECK.
	FM arrives within 200 meters of target.
	FM: CONTROL, THIS IS BLUE, IN POSITION, OVER.
	SMC: BLUE, THIS IS CONTROL, ROGER, OUT. (TO FDC) YOU ARE CLEARED.
	FDC: HANG IT, FIRE. Grenade simulator detonates.
	SMC: BLUE, MARK TARGET, OVER.
	FM: BLUE, MARKING TARGET, OUT.
	FDC: G21, SHOT, OVER.
	FIST: SHOT, OUT. . . DROP 50, FIRE FOR EFFECT, OVER.
	FDC: DROP 50, FIRE FOR EFFECT, OUT.
	SMC: Plots adjustment. BLUE, THIS IS CONTROL, DIRECTION 281 DEGREES, DISTANCE 50 METERS, FIRE FOR EFFECT, IN POSITION, OVER.
	FM: BLUE, DIRECTION 281 DEGREES, DISTANCE 50 METERS, FIRE FOR EFFECT, IN POSITION, OVER.
	FDC: DEFLECTION ___, CHARGE ___, 3 ROUNDS, ELEVATION 900.
	AC: CHECK
	SMC: YOU ARE CLEARED.
	FDC: HANG IT, FIRE. Grenade simulators detonate.
	SMC: BLUE, MARK FIRE FOR EFFECT, OVER.
	FM: BLUE FIRING FOR EFFECT . . . Throws the standard for fire for effect . . . ROUNDS COMPLETE, OVER.

PROCEDURE:	EXAMPLE: (107 mm mortar organic to cavalry platoon)
	SMC: BLUE ROUNDS COMPLETE, OUT.
	FDC: G21 SHOT, OVER.
	FIST: SHOT, OUT.
	FDC: ROUNDS COMPLETE, OVER.
	FIST: ROUNDS COMPLETE . . . END OF MISSION, MISSILE DESTROYED, OVER.
	FDC: END OF MISSION, MISSILE DESTROYED, OUT.
	SMC: BLUE, END OF MISSION, OVER.
	FM: END OF MISSION, OUT.
i. After mission is completed, FM will switch to controller frequency and assess casualties. FM then returns to fire marker net and renders a casualty report.	FM (on control net): TOW 65, DESTROYED BY MORTAR, TOW 65 DESTROYED BY MORTAR.
	(on fire marker net): CONTROL, THIS IS BLUE, OVER.
	SMC: BLUE, THIS IS CONTROL, OVER.
	FM: THIS IS BLUE, TOW 65 DESTROYED, OVER.
	SMC: THIS IS CONTROL, ROGER, OUT.
j. During lulls in the action, SMC requests location and ammunition status reports from fire markers.	SMC: ALL FIRE MARKERS, THIS IS CONTROL, STATUS REPORT, OVER.
	FM: THIS IS BLUE, GRID 873296; 8 HE, 10 AIR, 5 GRENADES, 1 POT, OVER.
	THIS IS WHITE, GRID 895298; 20 HE, 15 AIR, 5 GRENADES, 2 POTS, OVER.
	SMC: CONTROL, ROGER, OUT.

SECTION V
TRAINING PROGRAMS

1. Fire Markers

a. General.

Fire markers are the key to successful simulation of indirect fire. They must be able to mark the correct location within four minutes of receipt of a mission. To do this, fire markers must:

- be assigned an area that can be traversed within four minutes;
- be able to locate a point on the ground identified by six place coordinates or by an azimuth and distance from a known checkpoint;
- be able to communicate over the radio with observer or FMCC;
- be able to detonate simulators safely;
- be able to use a lensatic compass;
- be able to estimate distance accurately; and
- be able to assess casualties.

b. Tasks, Conditions, and Standards.

(1) Task 1: Locate own position
Conditions: Given a 1:50,000 map and a lensatic compass
Standards: In thirty seconds or less to within 150 meters (six place coordinates)

(2) Task 1a: Locate own position
Conditions: Given a 1:50,000 map, lensatic compass and surveyed checkpoints
Standards: In thirty seconds or less to within 150 meters

(3) Task 2: Locate a point on the ground
Conditions: Given a 1:50,000 map and a lensatic compass and the coordinates of a point within sight of present location.
Standards: In one minute or less to within 250 meters.

(4) Task 2a: Locate a point on the ground
Conditions: Given a 1:50,000 map, a lensatic compass, and the azimuth and distance from a known and occupied checkpoint.
Standards: Within 30 seconds or less to within 250 meters.

(5) Task 3: Communicate over tactical radio
Conditions: Given a PRC-77 or VRC-64, frequency and message to transmit and receive.
Standards: Turn radio on, tune frequency and transmit message, receive and record reply.

(6) Task 4: Detonate simulators safely
Conditions: Given ground burst simulator, air burst simulator, very pistol, smoke grenade and smoke pot.
Standards: Arm and fire all simulators, observing safety precautions.

(7) Task 5: Assess casualties
Conditions: Given a controller gun and information as to type and number of rounds fired.
Standards: Use controller gun to assess casualties within the appropriate radius of effect, ± 10%.

c. **Program of Instruction.**

(1) Introductory Mapreading (Classroom): 2 hours
Marginal information; topographic symbols; universal military grid system; resection; use of the declination diagram.

(2) Mapreading Practical Exercise: 6 hours
Lensatic compass; range estimation; map-terrain association, resection, use of checkpoints.

(3) Simulators: ½ hour
Types, uses, safety precautions, firing procedure, fire for effect procedure, practical exercise.

(4) Radio Procedure: ½ hour
Review of radio procedure, installing radio, tuning frequencies, sending and receiving messages, trouble-shooting.

(5) Terrain Familiarization: 4 hours
Practical exercise in locating self and targets in training area to be used for exercise. Fire markers and drivers should not only locate points, but must also learn fastest routes between points.

(6) Casualty Assessment: 3 hours
Radii of effect of 81mm and 107mm mortars, 155mm howitzer single rounds and fire for effect. Familiarization with controller gun. Sweeping the kill zone with the control gun. Reporting casualties. Practical exercise.

(7) Introduction to Fire Marker Procedure: 1 hour
Initial target location, subsequent corrections, fire for effect, assessment of casualties.

(8) Practical Exercise: 2 hours.
Practice in all missions with FMCC

(9) Test: 2 hours
Practical exercise in which fire markers are vectored out by radio to different targets and ordered to detonate different simulators. Fire markers will be checked on accuracy and time.

2. Fire Marker Control Center

a. General.

The Fire Marker Control Center (FMCC) must be able to compute and communicate orders to the fire marker quickly and accurately. If Fire Direction Centers are played, the FMCC must be superior in accuracy and speed to the FDC. It is assumed that FMCC will be manned by trained FDC personnel (MOS 11C or 13E) who already know FDC and radio-telephone procedures. The training program is only to familiarize them with the procedures peculiar to FMCC.

b. Tasks, Conditions and Standards.

(1) Task 1: Convert target location to azimuth and distance from nearest checkpoint.
Conditions: Given a grid sheet or map marked with checkpoints, protractor and measuring scale.
Standards: In 45 seconds or less, ± 1 degree, ± 30 meters.

(2) Task 2: Convert observer correction to azimuth and distance from last round.
Conditions: Given an M10 or M17 plotting board.
Standards: In 30 seconds or less, ± 10 mils, ± 20 meters.

(3) Task 3: Convert from grid azimuth in mils to magnetic azimuth in degrees.
Conditions: Given a mil-degree conversion table and a G-M angle.
Standards: In 15 seconds or less, ± 1 degree.

(4) Task 4: Process a mission from initial call for fire to fire for effect.
Conditions: Given FMCC equipment, checkpoint system, call for fire by FO, four (4) fire markers, two adjustments, fire for effect.
Standards: 30 seconds for initial data and 20 seconds for each subsequent correction, ± 1 degree and 20 meters per step.

c. Program of Instruction.

(1) Introduction to Procedures (Classroom): 1 hour
Engagement simulation, communications nets, equipment, radio procedure, plotting initial data and subsequent corrections, mil-degree conversion, application of G-M angle.

(2) **Practical Exercises: 4 hours**
Simulated missions.

(3) **Combined Practical Exercises: 2 hours**
Simulated missions with actual fire markers.

(4) **Test: 2 hours**
Simulated missions with actual fire markers.

3. Fire Unit Controllers

a. General.

The fire unit controller is assumed to be qualified in the weapons system he is to control. Training consists of refreshers in aiming circle operation and radio-telephone procedure and in the specific procedures used in control. If needed, fire unit controllers may join fire markers in map reading classes.

b. Tasks, Conditions and Standards.

(1) Task 1: Measure azimuth of fire with aiming circle.
Conditions: Given an aiming circle and a weapon with sight.
Standards: Within four minutes, ± 0 mils.

(2) Task 2: Operate a radio.
Conditions: Given a PRC-77.
Standards: Install battery, handset, antenna, set frequency, send and receive messages.

(3) Task 3: Provide fire unit data to FMCC.
Conditions: Given a fire unit simulating fire and a PRC-77.
Standards: Within one minute, check and send deflection, announced charge and quadrant ± 0 mils, 0 charge.

c. Training Program.

(1) Introduction to Fire Unit Controlling (Classroom): 1 hour
Engagement simulation, aiming circle, measuring azimuth, reporting data to FMCC, radio procedure.

(2) Practical Exercise: 3 hours
Aiming circle, measuring azimuth, checking deflection and quadrant, radio procedure.

4. Team Training

Eight hours of team training should be given in the field to all of the above, along with observers, FDCs and FBs (if played). Training should consist of mini-exercises to familiarize all parties with the procedures.

ANNEXES

ANNEX A

EQUIPMENT LIST

Fire Marker:

Vehicle with Radio–AN/PRC-77 (VRC-64 or GRC-160); AN/VRC-46
Map, acetate covered, on mapboard
Compass, lensatic
Binoculars
Clipboard
Coordinate square
Pencils, (lead and grease)
Mission sheets
Protractor

Fire Marker Control Center:

Vehicle with 3-channel transmit/receive capability (recommend track M577 with AN/VRC-46 and AN/VRC-49)
Antenna Groups RC-292 (3)
Grid sheets (with checkpoints marked, if checkpoint system is used)
Coordinate squares (3)
Protractors (3)
Map pins (with color-coded heads)
Maps on mapboards (3)
Field tables (3)
Head and chest sets (2)
Loudspeaker (1)
DA Forms 4504, Record of Fire Boards, Plotting, M10 or M17 (2)
FDC Equipment (Modules D and E only)

Firing Battery Controller (Module E only):

Radio, AN/PRC-77
Aiming Circle, M2
Map

Mortar Controllers (Module F only):

Radio, AN/PRC-77
Radio Control Set, AN/GRA-39
Map, acetate covered, on mapboard
Target grid, plastic, modified (Annex F)
Range scale (Annex G)
Clipboard
DA Form 2399
Firing tables for appropriate weapon, tabular or graphic
Head and chest set

ANNEX B

MISSION SHEET

Fire Marker _____

Call Sign: _____ Frequency: Control _____ Date: _____

From	Target Location	O-T Direction	Ammunition		Time		Kills
			No.	Type	Received	Delivered	

ANNEX C

Casualty Assessment

Indirect Fire

SINGLE ROUND BURSTING RADIUS*

Weapon	HE Ground	HE Air
81 mm. mortar	20 meters	30 meters
107 mm. mortar	30 meters	40 meters
105 mm. howitzer	30 meters	40 meters
155 mm. howitzer	50 meters	75 meters

AREA COVERED BY STANDARD FIRE FOR EFFECT**

(One Fire Unit (Mortar Platoon, FA BTRY) x 3rds per Tube)

Weapon	Area Covered	Rounds Represented in FFE
81 mm. mortar	100 x 50 meters	9
107 mm. mortar	200 x 50 meters	12
105 mm. howitzer	200 x 100 meters	18
155 mm. howitzer	300 x 150 meters	18

*Exposed soldiers within bursting radius are killed. Vehicles lose communications; 155 rounds immobilize vehicles within 10 meters of ground burst.

**Fire for effect will be marked by five simulators. All exposed soldiers in area are killed. All vehicles lose communications; 155 mm howitzer immobilizes vehicles.

ANNEX D

MILS TO DEGREES
CONVERSION TABLE

Mils	Degrees	Mils	Degrees	Mils	Degrees
100	6	2100	118	4100	231
200	11	2200	124	4200	236
300	17	2300	129	4300	242
400	22	2400	135	4400	247
500	28	2500	141	4500	253
600	34	2600	146	4600	259
700	39	2700	152	4700	264
800	45	2800	157	4800	270
900	51	2900	163	4900	276
1000	56	3000	169	5000	281
1100	62	3100	174	5100	287
1200	67	3200	180	5200	292
1300	73	3300	186	5300	298
1400	79	3400	191	5400	304
1500	84	3500	197	5500	309
1600	90	3600	202	5600	315
1700	96	3700	208	5700	321
1800	101	3800	214	5800	326
1900	107	3900	219	5900	332
2000	112	4000	225	6000	337
				6100	343
				6200	349
				6300	354
				6400	360

ANNEX E

RECORD OF FIRE

CALL FOR FIRE

Observer ______ AF/FFE/IS/S ______ Tgt ______

Grid ______

Polar Dir ______ Dis ______ U/D ______ VA ± ______

Shift ______ : Dir ______ L/R ______ +/- ______ U/D ______

△ FS	
100/R	
/R	
20/R	
± Si ÷ 10	10 mil Si
HOB Corr	

FIRE ORDER		Df Corr	Si
INITIAL FIRE COMMANDS | FM | MF	Rg	Chi Df	El
Sp Instr | Sh | Lot | Chg | Fz | Ti		Df	QE
MTO | ±T | PE_R | TF	in Eff		Ammo Exp

SUBSEQUENT FIRE COMMANDS

Tgt Dir; MF Sh; Fz	Location Dev	Priority Rg	Fuze Unit HOB Corr	MF; Sh Chg; Fz	FS Corr	Ti	Chart Df	Df Corr [ ]	Df Fired	Chart Rg	HOB Corr	Si [ ]	El	QE	AMMO Exp	AMMO Type

Btry	DTG	Tgt	Replot Grid	Replot Alt

DA FORM 4504, 1 MAY 76 — Replaces DA Form 3022, 1 Jan 74 and DA Form 4087, 1 Jan 73, which are obsolete.

For use of this form, see FM 6-40 and FM 6-40-5; the proponent agency is US Army Training and Doctrine Command.

ANNEX E1

FIRE RECORD CARD

FIRE RECORD CARD *Date:* _____ *Time Rec.* _____

Green/Brown
Observer _____ AF/FFE TGT LOC _____ DES _____

FIRE MARKER INITIAL DIRECTIONS: GRID/MAG CORR ± _____ CALLSIGN _____

FROM _____ DIR _____ DIS _____ OR GRID _____

SPEC INST _____

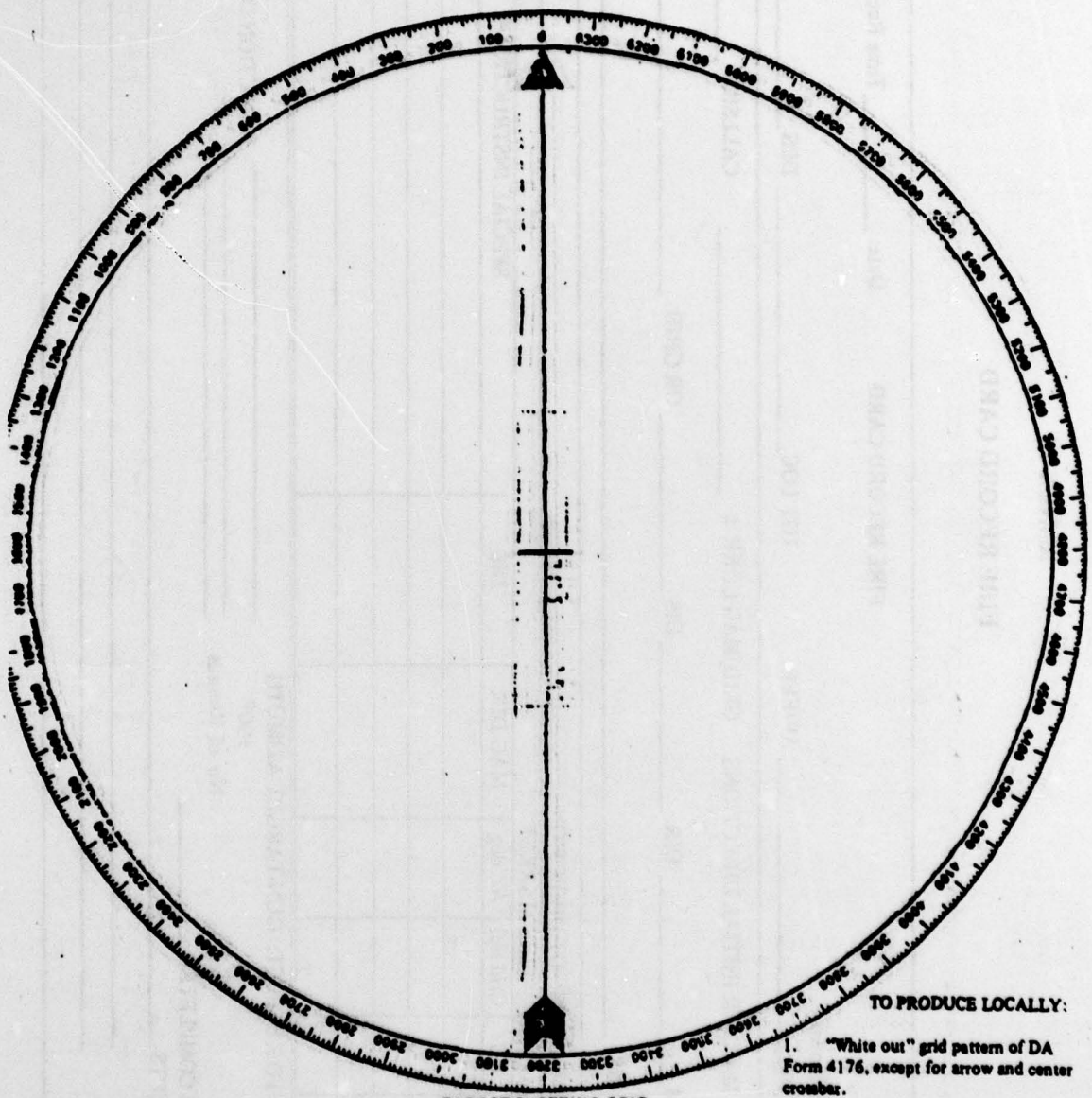
ADJUSTMENTS: OT DIRECTION _____

OBSERVER		FIRE MARKER				
DEV	RG	Grid mil	AZ deg	MAG DIR	DIS	SPECIAL INSTRUCTIONS

FIRE FOR EFFECT: GUN-TARGET AZIMUTH _____
+90° _____ DIRECTION OF FFE
No. of Rounds _____

TIME COMPLETED _____
EFFECTS _____

ANNEX F



TARGET PLOTTING GRID
FIELD ARTILLERY
GRADUATED IN MILS AND METERS
SCALE: 1: 25,000

TO PRODUCE LOCALLY:

1. "White out" grid pattern of DA Form 4176, except for arrow and center crossbar.

2. Run DA Form 4176 through Vu-Graph Slide Processing.

ANNEX G

Range scale may be produced by TASO out of plastic. Recommend a notch be cut at "0" end to facilitate placing against map pin.